

BIBLIOTHECA LICHENOLOGICA

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A Monograph of the Saxicolous Lecideoid Lichens of Australia (excl. Tasmania)

by

GERHARD RAMBOLD

With 67 maps and 31 figures in the text

Disbui. München
1989



J. CRAMER

in der Gebrüder Borntraeger Verlagsbuchhandlung

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A MONOGRAPH OF THE SAXICOLOUS
LECIDEOID LICHENS OF AUSTRALIA
(EXCL. TASMANIA)

Inaugural-Dissertation
zur Erlangung des Doktorgrades
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SYNOPSIS

This study presents a monograph of saxicolous lecideoid lichens occurring in continental Australia (*Fuscidea*, *Protoblastenia*, and *Trapelia* are excluded for several reasons). Sixty-four species belonging to eight families and twenty-two genera have been revised. Twenty-two of the taxa previously reported from continental Australia (FILSON 1988a) have been retained, thirteen with unchanged status.

The following thirty species, hitherto known from other regions, are reported as new for:

- a) continental Australia: *Poeltiaria coromandelica* (Zahlbr.) Rambold & Hertel and *Poeltiaria corralensis* (Räs.) Hertel.
- b) Australia: *Carbonea vorticosa* (Flk.) Hertel, *Immersaria athrocarpa* (Ach.) Rambold & Pietschmann, *Lecanora demersa* (Kremp.) Hertel & Rambold, *Lecidea fuscoatrula* Nyl., *Lecidea lapicida* (Ach.) Ach., *Lecidea lygomma* Nyl. in Cromb., *Lecidea plana* (Lahm) Nyl., *Lecidella stigmatea* (Ach.) Hertel & Leuck., *Micarea erratica* (Koerb.) Hertel, Rambold & Pietschmann, *Poeltidea perusta* (Nyl.) Hertel & Hafellner, *Porpidia crustulata* (Ach.) Hertel & Knoph, *Rimularia insularis* (Nyl.) Rambold & Hertel, and *Rimularia psephota* (Tuck.) Hertel & Rambold.
- c) Australasia: *Austrolecia antarctica* Hertel, *Carbonea montevidensis* (Müll.Arg.) Rambold & Knoph, *Lecidella enteroleucella* (Nyl.) Hertel, *Lecidea capensis* Zahlbr., and *Lecidea tragorum* Zahlbr.
- d) the Southern Hemisphere: *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold, *Lecanora marginata* (Schaer.) Hertel & Rambold, *Lecidea cerviniicola* B. de Lesd., *Lecidea diducens* Nyl., *Lecidea promiscens* Nyl., *Lecidella chodati* (Samp.) Knoph & Leuckert, *Miriquidica deusta* (Stenham.) Hertel & Rambold, *Miriquidica leucophaea* (Rabenh.) Hertel & Rambold, and *Porpidia contraponenda* (Arnold) Knoph & Hertel.

The following three species have been known from continental Australia under a more recent synonym: *Lecanora impressa* (Kremp.) Zahlbr., *Lecidea atromorio* Knight, and *Lecidea terrena* Nyl.

Two species, of which previous Australian reports are based on misidentified material, but which nevertheless occur in Australia, are: *Lecidea atrobrunnea* (Lam. & DC.) Schaer. and *Porpidia speirea* (Ach.) Kremp.

Five species are described as new: *Biatora solediosa* Rambold sp. nov., *Lecidea lygommoides* Rambold sp. nov., *Paraporpidia aboriginum* Rambold sp. nov., *Schaereria xerophila* Rambold & Mayrhofer sp. nov., and *Tephromela arafurensis* Rambold sp. nov.

Sixteen new combinations of species and varieties are proposed: *Biatora scorigena* (Müll.Arg.) Rambold comb. nov., *Carbonea montevidensis* (Müll.Arg.) Rambold & Knoph comb. nov., *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold comb. nov., *Immersaria athrocarpa* (Ach.) Rambold & Pietschmann comb. nov., *Lecanora disjungenda* (Cromb.) Hertel & Rambold comb. nov., *Lecanora oreinoides* (Koerb.) Hertel & Rambold comb. nov., *Lecidella buelliastrum* (Müll.Arg.) Knoph & Rambold comb. nov., *Micarea erratica* (Koerb.) Hertel, Rambold & Pietschmann comb. nov., *Paraporpidia glauca* (Th. Tayl.) Rambold comb. nov., *Paraporpidia leptocarpa* (Bab. & Mitt.) Rambold & Hertel comb. nov., *Poeltiaria coromandelica* (Zahlbr.) Rambold & Hertel comb. nov., *Poeltiaria ho-*

wickensis (Vain.) Rambold & Haiduk comb. nov., *Porpidia albocaerulescens* var. *polycarpiza* (Vain.) Rambold & Hertel comb. nov., *Porpidia soredizodes* (Lamy) Knoph, Hertel & Rambold comb. nov., and *Pyrrhospora sanguinolenta* (Kremp.) Rambold & Hafellner comb. nov.

Within the genus *Lecidea* Ach., three subgeneric units have been distinguished and combined as follows: *Lecidea* subg. *Lecidea*, *Lecidea* subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann comb. nov., and *Lecidea* subg. *Cladopycnidium* (H.Magn.) Hertel, Rambold & Pietschmann comb. nov.

The genus *Miriquidica* Hertel & Rambold is reported as new for the Southern Hemisphere.

The genera *Immersaria* Rambold & Pietschmann gen. nov. and *Paraporpidia* Rambold & Pietschmann gen. nov. are described as new.

Heppsoara Awasthi & K.Singh is regarded as a synonym of *Tephromela* Choisy, and *Diomedella* Hertel as a synonym of *Lecanora* Fée.

The insufficiently known genera *Fuscidea* V.Wirth & Vězda, *Protoblastenia* (Zahlbr.) Steiner, and *Trapelia* Choisy have been excluded from this study and Australian material will be revised separately.

The families Biatoreaceae Massal. ex Stiz. and Tephromelataceae Hafellner are regarded as synonymous with Lecanoraceae Fée emend. Hafellner.

A key and descriptions of the anatomical, morphological and chemical features are given for all species dealt with in this study. Taxonomic affinities, ecological behaviour and infraspecific variation are discussed. The distribution of each species within continental Australia is mapped.

Zusammenfassung

Vorliegende Arbeit stellt eine Monographie saxicoler lecideoider Flechtengattungen des australischen Kontinents (excl. Tasmaniens) dar (*Fuscidea*, *Protoblastenia* und *Trapelia* wurden aus verschiedenen Gründen ausgeschlossen). 64 Arten aus acht Familien und 22 Gattungen wurden revidiert. Von den bislang für Australien gemeldeten Taxa (FILSON 1988a) werden 22 beibehalten, 13 mit unverändertem Status.

Folgende 30 Arten, bisher nur bekannt aus anderen Gebieten, werden als neu gemeldet für:

- a) den australischen Kontinent (excl. Tasmanien): *Poeltiaria coromandelica* (Zahlbr.) Rambold & Hertel und *Poeltiaria corralensis* (Räs.) Hertel.
- b) Australien: *Carbonea vorticosa* (Flk.) Hertel, *Immersaria athroocarpa* (Ach.) Rambold & Pietschmann, *Lecanora demersa* (Kremp.) Hertel & Rambold, *Lecidea fuscoatrula* Nyl., *Lecidea lapicida* (Ach.) Ach., *Lecidea lygomma* Nyl. in Cromb., *Lecidea plana* (Lahm) Nyl., *Lecidella stigmata* (Ach.) Hertel & Leuck., *Micarea erratica* (Korb.) Hertel, Rambold & Pietschmann, *Poeltidea perusta* (Nyl.) Hertel & Hafellner, *Porpidia crustulata* (Ach.) Hertel & Knoph, *Rimularia insularis* (Nyl.) Rambold & Hertel und *Rimularia psephota* (Tuck.) Hertel & Rambold.
- c) Australasien: *Austrolecia antarctica* Hertel, *Carbonea montevidensis* (Müll.Arg.) Rambold & Knoph, *Lecidella enteroleucella* (Nyl.) Hertel, *Lecidea capensis* Zahlbr. und *Lecidea tragorum* Zahlbr.

d) die Südhemisphäre: *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold, *Lecanora marginata* (Schaer.) Hertel & Rambold, *Lecidea cervinii*-cola B. de Lesd., *Lecidea diducens* Nyl., *Lecidea promiscens* Nyl., *Lecidella chodati* (Samp.) Knoph & Leuckert, *Miriquidica deusta* (Stenham.) Hertel & Rambold, *Miriquidica leucophaea* (Rabenh.) Hertel & Rambold, und *Porpidia contraponenda* (Arnold) Knoph & Hertel.

Folgende drei Arten waren aus Australien unter einem jüngeren Synonym bekannt: *Lecanora impressa* (Kremp.) Zahlbr., *Lecidea atromorio* Knight und *Lecidea terrena* Nyl.

Zwei Arten, deren bisherige australische Nachweise auf Fehlbestimmungen beruhen, aber dennoch in Australien vorkommen, sind: *Lecidea atrobrunnea* (Lam. & DC.) Schaer. und *Porpidia speirea* (Ach.) Kremp.

Neu beschrieben werden fünf Arten: *Biatora soresdiosa* Rambold sp. nov., *Lecidea lygommoides* Rambold sp. nov., *Paraporpidia aboriginum* Rambold sp. nov., *Schaereria xerophila* Rambold & Mayrhofer sp. nov. und *Tephromela arafurensis* Rambold sp. nov.

Es werden 16 Neukombinationen auf Art- bzw. Varietätsrang vorgeschlagen: *Biatora scorigena* (Müll.Arg.) Rambold comb. nov., *Carbonea montevidensis* (Müll.Arg.) Rambold & Knoph comb. nov., *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold comb. nov., *Immersaria athroocarpa* (Ach.) Rambold & Pietschmann comb. nov., *Lecanora demersa* (Kremp.) Hertel & Rambold comb. nov., *Lecanora disjungenda* (Cromb.) Hertel & Rambold comb. nov., *Lecanora oreinoides* (Koerb.) Hertel & Rambold comb. nov., *Lecidella buelliastrum* (Müll.Arg.) Knoph & Rambold, *Micareia erratica* (Koerb.) Hertel, Rambold & Pietschmann comb. nov., *Paraporpidia glauca* (Th.Tayl.) Rambold comb. nov., *Paraporpidia leptocarpa* (Bab. & Mitt.) Rambold & Hertel comb. nov., *Poeltiaria coromandelica* (Zahlbr.) Rambold & Hertel comb. nov., *Poeltiaria howickensis* (Vain.) Rambold & Haiduk comb. nov., *Porpidia albocaerulescens* var. *polycarpiza* (Vain.) Rambold & Hertel comb. nov., *Porpidia soresdizodes* (Lamy) Knoph, Hertel & Rambold comb. nov. und *Pyrrhospora sanguinolenta* (Kremp.) Rambold & Hafellner comb. nov.

Innerhalb der Gattung *Lecidea* Ach. werden drei subgenerische Einheiten unterschieden und wie folgt kombiniert: *Lecidea* subg. *Lecidea*, *Lecidea* subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann comb. nov. und *Lecidea* subg. *Cladopycnidium* (H.Magn.) Hertel, Rambold & Pietschmann comb. nov.

Die Gattung *Miriquidica* Hertel & Rambold wird als neu für die Südhemisphäre gemeldet.

Die Gattungen *Immersaria* Rambold & Pietschmann gen. nov. und *Paraporpidia* Rambold & Pietschmann gen. nov. werden neu beschrieben.

Heppsora Awasthi & K.Singh wird als Synonym von *Tephromela* Choisy erkannt, *Diomedella* Hertel als Synonym von *Lecanora* Fée betrachtet.

Die Gattungen *Fuscidea* V.Wirth & Vězda, *Protoblastenia* (Zahlbr.) Steiner und *Trapelia* Choisy werden aus dieser Studie ausgeschlossen und für Australien in einer separaten Arbeit behandelt.

Die Familien Biatoraceae Massal. ex Stiz. und Tephromelataceae Hafellner werden als synonym zur Familie Lecanoraceae Fée emend. Hafellner betrachtet.

Ein Bestimmungsschlüssel zur Identifizierung der behandelten Arten sowie Beschreibungen der anatomischen, morphologischen und chemi-

schen Merkmale aller behandelten Sippen werden gegeben. Die Verwandtschaftsverhältnisse, das ökologische Verhalten und die Variabilität der verschiedenen Taxa werden diskutiert. Die kontinental-australischen Verbreitungsareale der Arten sind auf Karten dargestellt.

1. INTRODUCTION

Australian lichens have been collected for about 200 years and the earliest publications in which Australian taxa are described or listed, date back to 1806 (FILSON 1976). However it was only in about the last fifteen years that the first monographs of Australian lichen genera were published, e.g. *Heterodea* by FILSON (1978), *Hypogymnia* by ELIX (1979) and *Cladia* by FILSON (1981). Along with an increasing number of smaller contributions to the systematic representation of Australian lichens, some more extensive monographic revisions of the following genera occurring in Australia have been published since: the saxicolous species of *Rinodina* s.l. by MAYRHOFER (1984); *Xanthoparmelia* by ELIX & al.; *Ramalina* by STEVENS (1987); *Heppia* and *Peltula* by FILSON (1988b). Revisions of the genera *Caloplaca* (by R.Filson), *Leptogium* (by D.Verdon), *Pseudoparmelia* (by J.A.Elix & J.Johnston), and *Usnea* (by R.Rogers & N. Stevens) are in preparation (SIPMAN & SEAWARD 1988: 45).

This monograph on selected saxicolous lecideoid lichens in Australia deals with an heterogeneous group of lichens, which are commonly known as representatives of *Lecidea* sensu Zahlbruckner. They comprise several hundreds species worldwide and locally may comprise the major percentage of rock covering, especially at higher altitudes. Lecideoid lichens occur in all climatic zones at all altitudes where lichen growth is possible. Some genera, or even single species, show a wide ecological amplitude, ranging from sea level to alpine habitats and growing under cool temperate as well as tropical conditions; others have more specialized environmental requirements. As we know from previous revisions of lecideoid lichens of Europe and Asia, e.g. by HERTEL (1977), INOUE (1982, 1983a,b,c), SCHWAB (1986) and a study of the Subantarctic species by HERTEL (1984), most of the lecideoid genera comprise widely distributed species. This observation contrasts with the statements of some authors, e.g. GALLOWAY (1985) in the Lichen Flora of New Zealand, who suggests that the rate of endemism within the lecideoid lichens can be very high. Regarding this and the fact that the oldest name of a widespread and probably repeatedly described species is very often based on material from Europe, where the first lichenologists were active, it becomes clear that the revisions cited above represent a necessary precondition for a monograph on the Australian lecideoid lichens.

Studies for a monograph of the lecideoid lichens of the Antarctic floral region, which also included material from south-eastern Australia (first results in HERTEL 1984, 1985, 1987b) soon revealed that a revision

of the species of the whole Australian continent was necessary. The preconditions for such a project were excellent for several reasons: a) existing monographs for other regions formed the necessary background; b) all Australian type material already had been located by R. Filson and R. Rogers (FILSON 1986b); c) easy accessibility, i.e. availability of historical and recent collections from Australian and Extra-Australian herbaria; d) the recent increase in collecting by Australian and non-Australian lichenologists; e) the opportunity for four months of fieldwork for the author, made possible by Australian authorities and supported by Australian lichenologists.

1.1. Historical review of the generic concept of *Lecidea* s.l.

Lecidea was first described by ACHARIUS (1803). As shown in HERTEL (1987a: 220, fig. 1), only a small percentage of the originally included species still remains in this genus today. While ACHARIUS' (l.c.) system was based only on macroscopic thallus and ascocarp features, MASSALONGO (1852) used microscopic criteria, especially spore characters, for his generic concept. He divided the crustose species having a green alga as photobiont, a non-thalline apothecium margin and non-septate, colourless spores into the three (already described) genera *Biatora*, *Lecidea* and *Psora*. Three years later, KOERBER (1855) presented a much more detailed concept for lecideoid lichens, accepting the three cited genera plus *Micarea* and creating five new ones: *Lecidella*, *Porpidia*, *Pyrrhospora*, *Schaereria* and *Stenhammara* "Flot. in litt." [= *Stenhammaria* Hertel].

In the same year NYLANDER (1855) proposed a classification, which contrasted with MASSALONGO's and KOERBER's concepts (HALE 1984), and in which he used the name *Lecidea* in a very broad sense, including species with non-septate and septate, unpigmented and pigmented spores, e.g. members of *Buellia*, *Gyalecta*, and *Rhizocarpon*. KOERBER (1859 - 1865) differentiated his own system and subdivided the genera (proposed in KOERBER 1855), into various stirpes, which are generally regarded as separate genera today.

FRIES (1874) proposed a system based on the genus concept of MASSALONGO (l.c.). However, the three entities *Biatora*, (*Eu-*) *lecidea* and *Psora* were treated as subgenera (together with a fourth subgenus *Mycoblastus*) and subg. *Biatora* was subdivided into twelve stirpes, subg. *Eulecidea* into fourteen stirpes. On the whole, the system of FRIES was accepted by ZAHLBRUCKNER (1907, 1926), who excluded *Mycoblastus* from *Lecidea*.

In his lichenological contributions, VAINIO used two different concepts. In 1890 and 1909 he followed NYLANDER (e.g. 1855), including units with coloured and septate spores in *Lecidea*. Later, VAINIO (1934) accepted the system of FRIES and ZAHLBRUCKNER (l.c.), but included *Biatora* in the subgenus *Eulecidea* and regarded *Protoblastenia* as a separate subgenus.

Many other authors of this century followed ZAHLBRUCKNER's system, which even today is still used in some herbaria. Meanwhile, several authors segregated a large number of species, previously included in *Lecidea* sensu Zahlbruckner, into separate genera (HERTEL & RAMBOLD 1985: 472 - 473). In some cases, already existing names, placed in synonymy of *Lecidea* or other genera, were available (e.g. *Amygdalaria*). Some species were recognized as members of other well known genera (e.g. *Lecanora*, *Protoparmelia*). Even now, ZAHLBRUCKNER's system can not be replaced completely by a new one, because only a part of the more than one thousand catalogued species (ZAHLBRUCKNER 1925, 1932, 1940, LAMB 1963) have been examined using modern diagnostic criteria. Thus, the discovery of more genera, especially among the corticolous representatives, is still expected. For a clear verbal distinction of *Lecidea* sensu Zahlbruckner and *Lecidea* in the modern concept, HERTEL (1984) introduced the term "lecideoid lichens" in reference to lichens, defined by the following combination of characteristics: a) major photobiont belonging to the Chlorophyta, b) crustose growth form, c) non-septate, mostly colourless spores, d) non-thalline or $\pm$ reduced margin of apothecia. A synopsis of the genera comprising such lecideoid lichens is given in table 1, p. 26, 27, arranged according to the year of publication.

1.2. Collectors and authors of Australian saxicolous lecideoid lichens

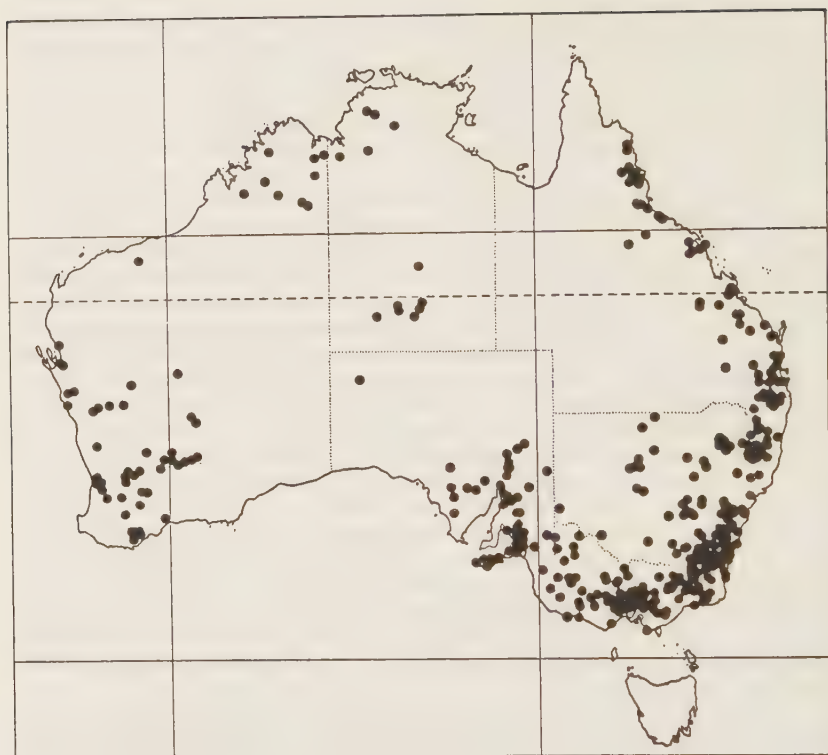
The first Australian collections of species, described under *Lecidea*, were made early in Australian history. In 1827 PERSOON described *Lecidea ochroleuca* Pers. in Gaudich., which, according to the original description, is a saxicolous species and was collected in Western Australia at Shark Bay [collector not named]. However, the type of this taxon could not be located in any herbarium (FILSON 1986b). Between 1802 and 1805 Robert Brown collected a corticolous species in New South Wales (Grose River) and a muscicolous one in Tasmania (Risdon Cove) during his voyages with Matthew Flinders. These two species were described as *Lecidea immarginata* Cromb. and *Lecidea flindersii* Cromb. nearly eighty years later (CROMBIE 1879). The first Australian lecideoid saxicolous or terricolous lichens, for which the type material has been located, were collected in 1843 by the government botanist and explorer J.Drummond in Western Australia (Swan River). They were described by Th.Taylor as *Lecidea glauca* Th. Tayl. [= *Paraporphidia glauca*] and *Lecidea crystallifera* Th.Tayl. [= *Eremastrella crystallifera*] in 1847 (TAYLOR 1847). Two species from Tasmania, described by C.Babington and W.Mitten in HOOKER (1859) twelve years later, are *Lecidea leptocarpa* Bab. & Mitt. [= *Paraporphidia leptocarpa*], which was collected by Gunn, and *Lecidea petraeoides* Bab. & Mitt. [= *Protoparmelia petraeoides*] with an unnamed collector, but probably collected either by Gunn or by J.D.Hooker. Both species are common in non-arid areas of Australasia. In 1862 the German lichenologist G.W.Koerber described the lecideoid *Aspicilia oreinoides* Koerb. [= *Lecanora oreinoides*] and *Lecidella turgescens* Koerb. [= *Poeltiaria turgescens*], collected by C.G. v. Hofstetter. Not until 1877 did the

German lichenologist A. Krempelhuber describe the conspicuous lecideoid *Calloposma sanguinolentum* Kremp. [= *Pyrrhospora sanguinolenta*]. He and other European lichenologists, e.g. Jean Müller (Müller Argoviensis) and James Stirton, obtained Australian lichen material forwarded by the Victorian Government Botanist Ferdinand v. Müller, who received it from several botanists or collectors, e.g. A. Thozet, J. Hamilton, R. Helms, J.G.Luehmann, and J.O.G. Tepper (see also the Index Collectorum).

During the last two decades of the last century, the collecting activities in Australia concerning lichens increased, and a number of species was described during that time. Most of the material from that time which was examined during this study, was collected by Reverend Francis R.M. Wilson (1832 - 1903), a Presbyterian minister and amateur botanist. He was active in Victoria (especially in the area surrounding Melbourne), New South Wales, Queensland and South Australia. His collections are housed in the Melbourne Herbarium (MEL) and in the Sydney Herbarium (NSW). In 1880 A.Krempelhuber created two synonyms: he described *Lecidea aspidula* Kremp. [= *Protoparmelia petraeoides*], based on material from Queensland which was collected by the botanical collector Anthelme Thozet; and *Lecidea plana* Kremp., an illegitimate homonym of *Lecidea plana* (Lahm) Nyl. which was based on material from South Australia and conspecific with the European *Lecidea confluentula* Müll. Arg., and *Lecidea ochroleuca* Pers., which is neotypified in this study. With the exception of *Lecidea buelliastrum* Müll.Arg. [= *Lecidella buelliastrum*], all species described during the 1880's by STIRTON (1881), KNIGHT (1882), KNIGHT in SHIRLEY (1889), NYLANDER (1886) and MÜLLER ARGOVIENSIS (1887a,b, 1888), proved to be synonyms of older taxa (tab. 5, p. 58, 59).

Also, some of the specimens collected by F.R.M.Wilson were described as new species, mainly by Jean Müller (MÜLLER ARGOVIENSIS 1893, 1895) and much later by V. Räsänen (see below). The former also described some species based on collections by the New Zealand surgeon Charles Knight (MÜLLER ARGOVIENSIS 1895). Nearly all of them are synonymous with other taxa. According to the original descriptions and the labels on the specimens, several types were collected on Thursday Island (North Queensland). However in the cases of *Lecidea nesophila* Müll.Arg. [= *Lecidella sublapicida*] and *Lecidea insulana* Müll.Arg. [= *Lecanora subcoarctata*], this seems very unlikely, as all the other examined specimens of these species are derived from much more southerly localities. *Lecanora subcoarctata* is known only from Tasmania and New Zealand. So it seems likely that the type locality of these, and probably some other, taxa described in MÜLLER ARGOVIENSIS (1895), differs from that indicated.

From the beginning of this century up to the sixties, only few collections of lecideoid lichens have been made. Some important collectors were Richard Austin Bastow (collected *Lecidea* s.l. between 1899 and 1902), Edwin Cheel (between 1900 and 1909), and Patrick N. S. Bibby (between 1945 and 1948). In 1944 and 1949 Veli Räsänen described five species and one variety under *Lecidea*, all based on material collected by F.R.M.Wilson in 1892 and 1893. In this study all of these taxa have been reduced to synonymy.



Map 1. Collecting localities of lecideoid lichens in continental Australia

In the early sixties lichenology in Australia received new impetus, especially as a result of the activities of the Australian lichenologists Rex Filson and Rod W. Rogers. From that time on, the number of collected lecideoid lichens and lichens as a whole, increased greatly (fig. 1, map 1). Important recent and present day collectors of lecideoid lichens in continental Australia are the Australian lichenologists N.N.Donner (AD), J.A.Elix (ANUC, MEL), R.Filson (MEL), R.W.Rogers (AD, BRIU), N.Sammy (PERTH), H.Streimann (mainly CBG), and D.Verdon (CBG). A large number of specimens examined in this study were collected by the American lichenologist W.A.Weber (COLO) and the European lichenologists J.Ha-fellner (GZU), H.Hertel (M), H.Mayrhofer (GZU), P.W.James (BM) and V.Wirth (STU). From January to April 1986, the author had the opportunity to travel through all states of continental Australia and make ample collections of lecideoid and other lichens from 129 different localities (RAMBOLD 1986). Further details concerning collectors are given in the Index Collectorum below.

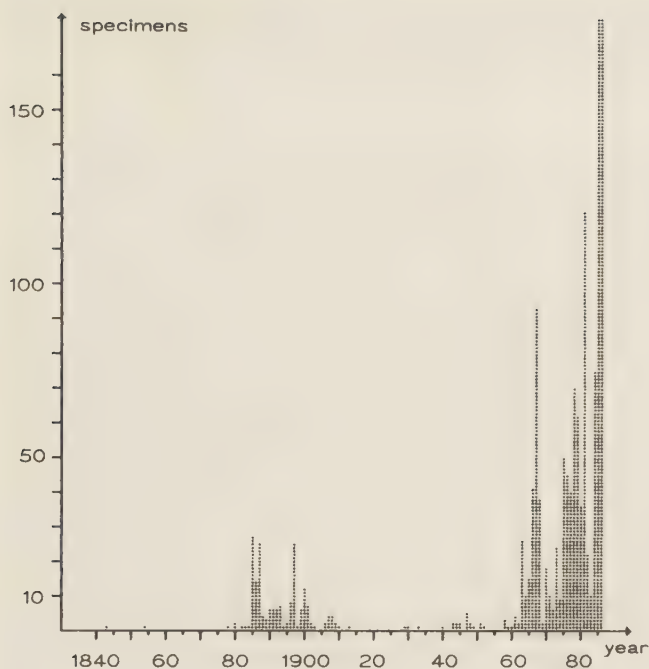


Fig. 1. Numbers of lecideoid lichens collected in continental Australia between 1840 and 1986 (number of specimens collected per year). The columns for 1985 and 1986 have been curtailed.

INDEX COLLECTORUM

This index contains all the collectors of saxicolous lecideoid lichens, whose collections have been examined in this study. For each person the following personal data - if available - are given: surname, first name and further names, year of birth (and death), profession, source of information [(1)-(7)], the herbaria where the collections are deposited, and (in brackets) localities (states) and dates of the collections. Information about academic qualifications often was not available and therefore omitted in all cases.

[(1) personal communication from the individual referred to; (2) according to WILLIS & al. (1986); (3) according to HERTEL (1980), HERTEL & SCHREIBER (1988); (4) J.A.Elix (pers. comm.); (5) R.Filson (pers. comm.); (6) B.R.Maslin (pers. comm.); (7) H.Streimann (pers. comm.)]

Allender, Marie Joyce (1917 - x), herbarium assistant (2), MEL (Vic., 1965); -- **Anderson**, Garry W. (?1945 - x), botanist (6), MEL (Vic., 1970); -- **Ashton**, David Hungerford (1927 - x), botanist, ecologist (2), MEL (Vic., 1963, 1967).

Bailey, Frederick Manson (1827 - 1915), botanist (2), BM, BRI (Qld, 1889); -- **Baird**, Alison Mary (1906- x), botanist, ecologist (2), MEL (W.A., 1933, 1945); -- **Barnsley**, Barbara (1935 - x), horticulturalist (1), CBG (N.S.W., 1978); -- **Bastow**, Richard Austin (1839 - 1920), draftsman, cryptogamist (2), MEL (Vic., 1899 - 1901); -- **Beard**, E. (? - x), MEL (S.A., 1967); -- **Beaton**, Gordon William (1911 - x), mycologist, photographer (2), BM (Vic., 1963, 1964); -- **Beaulehole**, Alexander Clifford (1920 - x), farmer, botanist (2), MEL (W.A., N.T., S.A., Vic., 1948, 1949, 1962, 1965, 1966, 1968); -- **Belcher**, Robert O. (1918 - x), botanist (2), COLO (N.S.W., 1967); -- **Bibby**, Patrick Noel Sumner (1907 - 1955), botanist (2), MEL, UPS (Vic., 1945, 1947, 1948); -- **Boorman**, John Luke (1864 - 1938), gardener, herbarium collector (2), NSW (N.S.W., 1906); -- **Bratt**, Geoffrey Charles (1931 - 1977), chemist, lichenologist (5), HO (W.A., S.A., Vic., 1967, 1968, 1970, 1976); -- **Bratt**, Margaret H. (? - x), wife of G.B. (5), HO (N.S.W., 1975); -- **Briggs**, Barbara Gillian (1934 - x), botanist, geneticist (2), COLO (N.S.W., 1964); -- **Brownlie**, John R. (?) (? - x), MEL (N.T., 1970).

Canning, Estelle Margaret (1936 - x), botanist (2), CBG (N.S.W., 1979); -- **Cheel**, Edwin (1872 - 1951), botanist (2), NSW (N.S.W., 1900, 1907, 1908, 1909, 1913); -- **Crawford**, N.(?)R. (? - x), G (N.S.W, 1884); -- **Crisp**, Michael Douglas (1950 - x), botanist, ecologist (1), CBG (N.S.W., 1978); -- **Curtis**, John Drew (1948 - x), technician (5), MEL (S.A., 1967); -- **Cruickshank**, Veda M. (1960 - x), artist (2), AD (S.A., 1968); -- **Cummings**, David J. (? - x), soil scientist (7), CBG (Vic., 1977); -- **Curnow**, Judith Ann (1956- x), technical assistant (1), CBG, (S.A., N.S.W., A.C.T., 1984, 1985).

Dakin, Edward Thomas (1897 - 1955), gardener (2), MEL (Vic., 1952); -- **Day**, Max F. (? - x), technical assistant (4), ANUC (W.A., 1982); -- **Donner**, Nicholas Nicholaiewitsch (1921 - x), botanist, lichenologist (1), AD, COLO, MEL (S.A., 1967, 1973, 1974, 1977, 1981); -- **Drummond**, James (1784 - 1863), government botanist, explorer (2), BM, E, G (W.A., 1843).

Elix, John Alan (Jack) (1941 - x), chemist, lichenologist (1), ANUC, CANB, CBG, MEL, M (all states, 1975 - 1988); -- **Everett**, Joy (1953 - x), botanist (1), NSW (N.S.W., 1985).

Filmer, W.D. (? - x), NSW (N.S.W. 1908); -- **Filson**, Rex Bertram (1930- x), botanist, lichenologist (1), MEL (W.A., S.A., N.S.W., Vic., 1963 - 1986); -- **Filson**, Susan Ann (1942 - x), librarian (wife of R.F.) (1), MEL; -- **French**, Charles Hamilton (1868 - 1950), botanist (5), MEL, UPS (Vic., 1944).

Gauba, Erwin (1891 - 1964), botanist (2), MEL, UPS (S.A., 1943); -- **Gaul**, K.L. (? - x), chemist (4), ANUC (N.S.W., 1986); -- **Geddes**, Anne (1955 -

x), herbarium assistant (5), MEL (Vic., 1980); -- **Gilbert**, M. (? - x), HO (Qld, N.S.W., 1974); -- **Green**, John William (1930 - x) botanist, curator (6), PERTH; -- **Goodall**, David William (1914 - x), botanist, ecologist (5), MEL (Vic., 1951); -- **Gregson**, Jesse (1837 - 1919) agricultural superintendent (2), NSW (N.S.W., 1903); -- **Gwyther**, G. Julian (? - x), (2), BM, GLAM (Qld, active 1890's).

Hamilton, Arthur Andrew (1855 - 1929), botanist, herbarium assistant (2), NSW (N.S.W., 1909); -- **Hafellner**, Josef (1951 - x), botanist, lichenologist, GZU, hb. Hafellner, (Qld, N.S.W., Vic., 1986); -- **Hartmann**, Carl Heinrich (1833 - 1887), nurseryman, lichenologist (2), G, MEL (Qld, 1887 ?); -- **Hawksworth**, David L. (1946 - x), botanist, lichenologist (2) BM (N.S.W., 1981); -- **Helms**, Richard (1842 - 1914), zoologist, botanist (2), MEL (W.A., S.A., 1891); -- **Hertel**, Hannes (1939 - x), botanist, lichenologist (1), M (N.S.W., Vic. 1985); -- **Hochstetter**, Christian Gottlob von (1829 - 1884), (3), M, L (? , no date); -- **Hnatiuk**, Roger James (1946 - x), ecologist (6), PERTH (W.A., 1977); -- **Holbeach**, P. (? - x), HO (Vic., 1972).

James, Peter Wilfrid (1930 - x), botanist, lichenologist (3), BM (N.S.W., Vic., A.C.T., 1963, 1984); -- **Jermy**, Anthony Clive (1932 - x), botanist, pteridologist (2), BM (Vic., 1981); -- **Johnson**, M. (? - x), MEL (W.A., 1930); -- **Jones**, David Lloyd (? - x), nurseryman, orchidologist (2), MEL (Qld, 1973).

Kenneally, Kevin Francis (1945 - x), botanist (2), PERTH (W.A., 1975); -- **Keys**, James (? - x), cryptogam collector (2), BRI (Qld, active 1890's); -- **Kilgour**, Roslyn Anne (1956 - x), technical assistant (1), MEL (Vic., 1984); -- **Knight**, Charles (1818 - 1895), surgeon, lichenologist (2), G, H-Nyl, M, WELT (Qld, 1887?); -- **Kraehenbuehl**, Darell Nairn (1934 - x), botanist (2), AD, MEL; -- **Kruiskamp**, John P. (? - x), PERTH (W.A., 1966).

Lamont, Byron Barnard (1945 - x), botanist, ecologist (2), PERTH (W.A., 1972); -- **Latz**, Peter Kenneth (1941 - x), botanist, agrostologist (2), MEL, NT (N.T., 1976); -- **Luehmann**, Johann George (1843 - 1904), botanist (2), G, MEL (Vic., 1891); -- **Lumbsch**, H. Thorsten (1964 - x), botanist, lichenologist (1), hb. Lumbsch (W.A, Qld, N.S.W., A.C.T., Vic., 1987).

McCrum, Eric (? - x), engineer (5), MEL (W.A., 1985); -- **McVean**, Donald N. (? - x), ecologist (7), CBG, COLO, HO, M (S.A., N.S.W., A.C.T., 1965, 1966, 1967, 1968); -- **Main**, Barbara (? - x), MEL (W.A., 1966); -- **Maiden**, Joseph Henry (1859 - 1925), botanist, eucalyptologist (2), NSW (N.S.W., 1899); -- **Maiten**, F. H. (? - x), NSW (Qld, 1897); -- **Malcolm**, Clive Vincent (1933 - x), ecologist (2), MEL; -- **Martin**, W. (? - x), MEL (Vic., no date); -- **Matthews**, Pamela (? - x), tram conductress (5), HO (N.S.W., 1967); -- **Mayrhofer**, Helmut (1953 - x), botanist, lichenologist (1), GZU, hb. Mayrhofer (S.A., N.S.W., Vic., 1981, 1984, 1985, 1988); -- **Mayrhofer**, Michaela (1955 - x), botanist, lichenologist (1), GZU (S.A., N.S.W., Vic., 1981); -- **Merrotsy**, P. (? - x), teacher (4), BRIU (N.S.W., 1986, 1987); -- **Miller**, Cathrine Helen (1958 - x), technical assistant (1), CANB (N.S.W., 1984, 1985); -- **Milewski**, Anthoni Vincent (1952 - x), ecologist (6), PERTH; -- **Morrison**, Herbert Allan (1901 - x), engineer, chemist (2), MEL (N.T., Vic., 1965, 1967); -- **Müller**, Ferdinand Jakob Heinrich von (1825 - 1896), botanist, director of the Botanic Garden in Melbourne (2), G, M (S.A., Vic., 1854, 1890); -- **Muir**, Thomas Bruce (1929 - x), botanist (2), MEL (Vic., 1963, 1977).

Perich, Helen (? - x), CANB, COLO (N.S.W., 1960); -- **Pope**, Clive (? - x), MEL (Qld, 1970).

Rambold, Gerhard Walter (1956 - x), botanist, lichenologist (1), M (all states excl. Tas., 1986); -- **Reader**, Felix Maximilian (1850 - 1911), botanist, pharmacist (2), MEL, NSW (Vic., 1883, 1894, 1897); -- **Richardson**, David Horsfall Stuart (1942 - x), botanist, lichenologist (3), PERTH (W.A., 1980); -- **Rogers**, Roderick Westgarth (1944 - x), botanist, lichenologist (1), AD, BRIU, COLO, MEL (W.A., S.A., Qld, N.S.W., 1966 - 1985); -- **Ross**, James Henderson (1941 - x) botanist (5), MEL.

Sammy, Nathan (1945 - x), lichenologist (5), PERTH (W.A., 1972, 1973, 1974, 1976, 1981); -- **Seppelt**, Rodney David (1945 - x), biologist (5), MEL (S.A., 1972); -- **Shirley**, John F. (1849 - 1922), teacher, lichen collector (2), BRI, NSW (Qld, 1888); -- **Streimann**, Heinar (1938 - x), botanist, bryologist (1), CBG, COLO, M (Qld, N.S.W., A.C.T., Vic. 1979 - 1985); -- **Sullivan**, Daniel (1836 - 1894), teacher, botanist (2), NSW (Vic., no date).

Thor, Göran (1953 - x), biologist, lichenologist (1), hb. Thor (Qld, 1985); -- **Thozet**, Anthelme (1826 - 1878), farmer, botanical collector (3), G, M (Qld, no date); -- **Thrower**, Stella L. (1925 - x), botanist (2), BM, COLO (N.S.W., Vic., 1958 - 1964).

Verdon, Douglas (1921 - x), lichenologist (7), CBG (N.S.W., A.C.T., Vic., 1975 - 1981).

Walter, Erna (1893 - x), biologist, cryptogam collector (2), M (W.A., 1958); -- **Watts**, William Walter Rev. (1856-1920), botanist (2), NSW (N.S.W., 1910); -- **Weber**, Josef Zvonko (? - x), botanist (2), AD (S.A., 1968); -- **Weber**, William Alfred (1918 - x), lichenologist, bryologist (2), CANB, CBG, COLO, HO, M (S.A., N.S.W., A.C.T., 1967, 1968); -- **Weeks**, Ronald C. (? - x), engineer, lichen collector (5), HO (Vic., 1968, 1970, 1976); -- **Whitehead**, Brian (? - x), (2), HO (S.A., 1975); -- **Willis**, James Hamlyn (1910 - x), botanist (2), MEL (Qld, N.S.W., Vic., 1940, 1943, 1963 - 1974); -- **Wilson**, Francis Robert Muter Rev. (1832 - 1903), presbyterian minister, lichenologist (2), G, H, MEL, NSW (S.A., Qld, N.S.W., Vic., 1885 - 1898); -- **Wirth**, Volkmar (1943 - x), botanist, lichenologist (3), STU (A.C.T., Vic., 1981); -- **Woolfs**, William Rev. (1814 - 1893), anglican dean, schoolmaster (2), MEL (N.S.W., no date).

2. MATERIAL AND METHODS

The material analyzed for this study is composed of herbarium material from institutes and private collections as acknowledged and collections of the author. During four months field work in all states of continental Australia, the author collected c. 3500 specimens from 129 localities, most of them lecideoid lichens.

All specimens have been analyzed microscopically and, if possible, chemically also. The examination of external morphological characters was carried out using a Zeiss wide field binocular microscope (12x and 40x). Anatomical characters were examined with an Olympus binocular biological microscope (100 x, 400 x, and 1000 x) using vertical sections cut by hand, or, for closer examination, vertical sections of 12 - 15 µm, cut using a Leitz freezing microtome. The pigmentation of the various tissues were examined in sections mounted in water. Lactophenol cotton blue was used as a staining agent for studying hyphal structures.

For the localisation of lichen substances a polarizing filter as well as the microscopical tests with the following solutions were used:

KOH-solution ["K"]: c. 10% aqueous solution of potassium hydroxide;

P-solution ["P"]: ethanolic solution of *p* - phenyldiamine;

C- solution ["C"]: saturated aqueous solution of calcium hypochlorite.

In most specimens the lichen substances were identified by means of thin-layer chromatography (TLC) using techniques as described in CULBERSON (1972), CULBERSON & AMMANN (1979) and WHITE & JAMES (1985). About 0.5 cm² of the thallus surface or less (with poorly developed samples or type specimens) were used for the chromatographical analysis. The acetone extraction was spotted on silicagel-coated glass plates (Merck 60 F-254). The chromatograms were usually developed in three solvent systems (solvents A, B, C). Solvent J (HANKO 1983) was used for the identification of xanthones.

Solvent A : Toluene : dioxane : acetic acid; 400 : 113 : 13 ml

Solvent B : Hexane : diethyl ether : formic acid; 200 : 150 : 33 ml

Solvent C : Toluene : acetic acid; 500 : 75 ml

Solvent J : Dichloromethane : acetone; 300 : 100 ml

The chromatogramms were examined under UV light at 254 nm and 350 nm, sprayed with a 10% aqueous solution of sulphuric acid (plates A,C) and anisaldehyde-sulphuric acid (RANDERATH 1965) (plate B) and heated to about 110 °C. Plates developed with solvent J were not sprayed or heated.

For the examination of amyloid reactions of medulla, hymenium and asci, the sections were put into a concentrated I-solution [I conc.]. Differing colour impressions of the amyloid reaction (i.e. blue reactions of outer ascus wall or of the hymenial gel) were observed in a less concentrated I-solution [I] (BARAL 1987).

3. RESULTS

3.1. The underlying family, genus and species concept

The family and genus concept of lichens in general and of the crustose lichens especially is still far from stable. The introduction of the amyloid structures of the tholus and of the chemism as taxonomically important diagnostic features have brought about the splitting of many genera and even families.

The most recent family system proposed for the genera formerly belonging to the Lecanoraceae and Lecideaceae was offered by HAFELLNER in his epoch-making paper in 1984. He divided these two family aggregates into fifty families, describing thirty-five new families and accepting fifteen already described by other authors. His system is based mainly on ascus and spore characters, as well as on the growth form and margination of the apothecia. HAFELLNER's taxonomic conclusions sometimes contradict his general discussion, where he points out, that within Lecanorales, differences in ascocarp development and in growth form generally should not be over estimated.

In this study, the amyloid structures of the tholi are regarded as important diagnostic characters at the family level as well as at the generic level. As shown by several authors (e.g. CLAUZADE & ROUX 1985, HERTEL & RAMBOLD 1985, 1988a), the relative size of the tholus structures can vary greatly, depending on the stage of development of the asci. They also can easily be artificially modified during preparation. Nevertheless the following main ascus types can be distinguished within lecideoid lichens:

- tholus more or less amyloid at the lateral parts, with a non-amyloid masse axiale and no amyloid zone above the masse axiale (fig. 2a, b): "*Lecanora* -type"; similar, but with an amyloid zone above the masse axiale: "*Bacidia* -type" (including "*Biatora* -type" sensu HERTEL 1984 and "*Lecidella* -type" sensu BELLEMERE & LETROUIT-GALINOU 1987)
- tholus amyloid, lacking axial structures (fig. 2c): "*Catillaria* -type"
- tholus amyloid, lacking axial structures and with a thick, amyloid outer gelatinous wall layer (fig. 2d): "*Fuscidea* -type"
- tholus not amyloid or slightly amyloid at the lateral parts, with an axial amyloid tube (fig. 2e): "*Porpidia* -type" sensu HERTEL 1984 (= "*Psora* -type" sensu BELLEMERE & LETROUIT-GALINOU 1987) or with an apical cap (?= reduced tube) (fig. 2f): "*Lecidea* -type"
- tholus amyloid at the lateral parts, with a non-amyloid central part and with an amyloid apical cap (or tube) (fig. 2g): "*Rimularia* -type"
- tholus more or less amyloid at the lateral parts and with a distinct amyloid apical cap (fig. 2h): "*Trapelia* -type"
- tholus not amyloid (fig. 2i): "*Tremolecia* -type"
- tholus $\pm$ not amyloid or reduced (fig. 2j): "*Schaereria* -type".

According to this concept, the lecideoid families sensu Hafellner are grouped as follows:

a) Biatoraceae, Lecanoraceae, Tephromelataceae

Species of the Biatoraceae and Tephromelataceae sensu HAFELLNER

(1984) have asci with a small, mostly converging masse axiale and an amyloid zone above. Those of the Lecanoraceae have asci with a broad cylindrical masse axiale without an amyloid wall layer above. HERTEL & RAMBOLD (1985) separated the Tephromelataceae and Lecanoraceae by these and other characteristics such as differences in the conidiogenous apparatus and in the form of the conidia. These differences, however, seem to be suitable only for a satisfying separation of genera but not of families since both ascus types have meanwhile been observed within *Lecanora* s.l., and several chemical conformities between the genera of these families have been found, which should not be ignored (KNOPH & RAMBOLD in prep.). For this reason, the Biatoreaceae and Tephromelataceae, which were regarded as synonymous to the Bacidiaceae by ERIKSSON & HAWKSWORTH (1987b), are probably better synonymized with the Lecanoraceae.

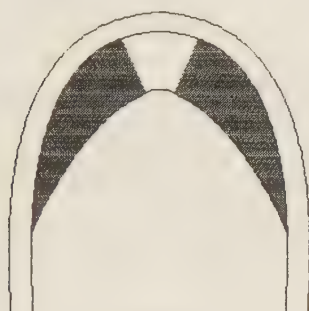


Fig. 2a.
"Lecanora - type"
(schematized)

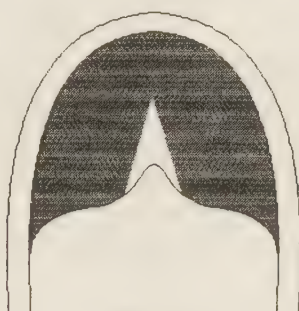


Fig. 2b.
"Bacidia - type"
(schematized)

b) Catillariaceae

The Catillariaceae comprise the genera *Austrolecia* Hertel, *Catillaria* Massal., and according to HERTEL & RAMBOLD (1988a), *Placolecis* Trev. They are characterized by asci with amyloid tholi without any visible masse axiale and by simple to 1-septate, non-halonate spores. *Austrolecia* and *Placolecis* are monotypic lecideoid genera, whereas there are no lecideoid representatives with non-septate spores known from *Catillaria*.

c) Fuscideaceae

The Fuscideaceae are characterized by an ascus structure, which shows that they belong to the Teloschistales. The family Orphniosporaceae Hafellner was included into the Fuscideaceae by HERTEL & RAMBOLD (1988b). [The species of the family Fuscideaceae are excluded from this study. Contributions to the genus *Fuscidea* have been made by MAGNUSSON (1925), WIRTH & VEZDA (1972) INOUE (1981a,b), JAMES, POELT & WIRTH (1981), and OBERHOLLENZER & WIRTH (1984)].

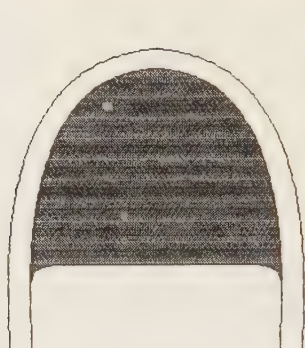


Fig. 2c.
"Catillaria - type"
(schematized)

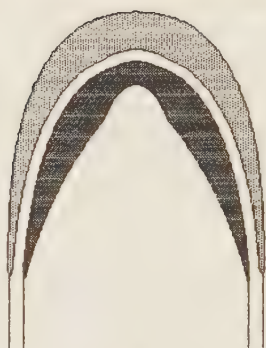


Fig. 2d.
"Fuscidea - type"
(schematized)

d) Lecideaceae, Micareaceae, Porpidiaceae

An amyloid tube is developed in the asci of the Porpidiaceae and Micareaceae. The amyloid cap, characteristic for the asci of the Lecideaceae, can be interpreted as a reduced amyloid tube. Close affinities of the Lecideaceae and Porpidiaceae are assumed by the author for the following reasons:

a) Some species in *Lecidea* occasionally show asci with amyloid caps as well as with tube-like amyloid structures similar to those in the

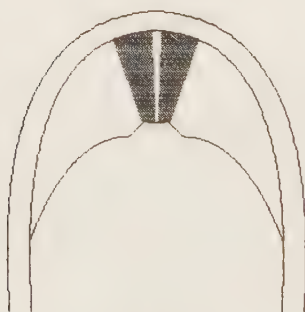


Fig. 2e.
"Porpidia - type"
(schematized)

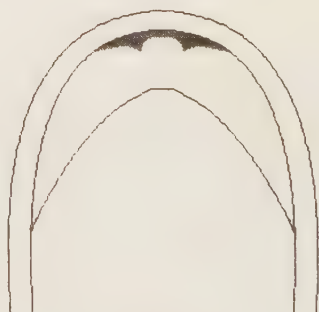


Fig. 2f.
"Lecidea - type"
(schematized)

Porpidiaceae.

b) Within the Porpidiaceae a tendency to non-halonate spores - they are obligatory in the Lecideaceae - is observable.

c) The species in both families contain several identical para-depsides.

d) Lecideaceae and Porpidiaceae are, with very few exceptions (e.g. species of *Cecidonia*), restricted to inorganic substrates.

The Micareaceae are probably somewhat distant from these two families. In this monograph, the Lecideaceae, Micareaceae and Porpidiaceae are accepted as separate families. A comparative study of the relationships between these and the other families with tube-like amyloid structures (e.g. Helocarpaceae, Koerberiellaceae, Lecidomataceae, Mycobilimbiaceae, Psoraceae, Squamarinaceae) is being prepared with M. Pietschmann.

e) Rimulariaceae, Agyriaceae (incl. Saccormorphaceae and Trapeliaceae)

The asci of the Agyriaceae (incl. Saccormorphaceae and Trapeliaceae) and the Rimulariaceae show an amyloid apical cap within a broad, diverging non-amyloid central part. In the Rimulariaceae, the amyloidity of the tholus is much more reactive and the structures are more distinct as in the Agyriaceae s.l. In several species of *Trapeliopsis* (Trapeliaceae) they often are hardly to recognize. Agyriaceae and Rimulariaceae are quite uniform with regard to their chemistry. Many species of both families contain gyrophoric acid, some of the Rimulariaceae also contain norstictic acid. However the occurrence of these two substances is rather nonspecific in many lichen groups. [The species of the family Agyriaceae (incl. Trapeliaceae and Saccormorphaceae) are excluded from this study and will be treated separately].

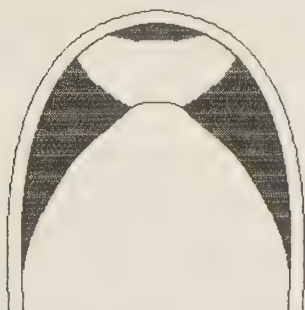


Fig. 2g.
"Rimularia - type"
(schematized)

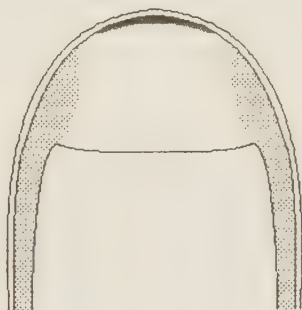


Fig. 2h.
"Trapelia - type"
(schematized)

f) Tremoleciaceae

The family Tremoleciaceae which probably is related to the Hymeneliaceae (HAFELLNER 1984), previously comprised the monotypic genus *Tremolecia*. The monotypic genus *Melanolecia*, which was tentatively included in this family by HAFELLNER (1984), has been preliminarily placed in the Lecideaceae by TRIEBEL & RAMBOLD (1988: 282), because

of an easily recognized amyloid cap in the tholus. However, it may also be related to genera of the Porpidiaceae, e.g. to *Farnoldia* Hertel.

g) Schaereriaceae

The family Schaereriaceae, which comprises the genera *Schaereria* and *Hafellnera* according to ERIKSSON & HAWKSWORTH (1989b), has asci with a thin, slightly amyloid or non-amyloid tholus.

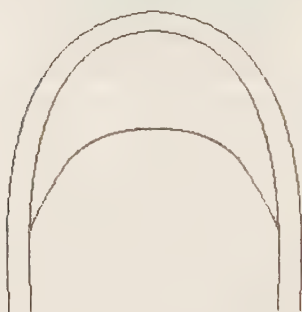


Fig. 2i.
"Tremolecia - type"
(schematized)

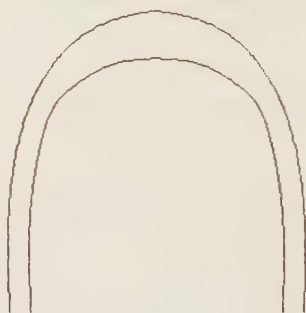


Fig. 2j.
"Schaereria - type"
(schematized)

As already mentioned, the generic concept of the families comprising lecideoid lichens is far from being stable and being commonly accepted. Particular problems in several genera are discussed in the taxonomic part. In this chapter, only some general aspects will be presented to enable a better appreciation of the problems in genus delimitation within lecideoid lichens.

Some authors working on genera of macrolichens regard the cortical substances as a valuable generic character, e.g. the occurrence of usnic acid in *Xanthoparmelia* and some other closely related genera (ELIX & al. 1986). Species without this cortical substance are consequently placed in separate genera. On the other hand, e.g. in the genus *Cladonia*, the occurrence of usnic acid has not yet been used as a main character for generic segregations (AHTI 1984). In most crustose lichen genera, the cortical substances have not yet been regarded as taxonomically relevant at the generic level either, e.g. in *Rhizocarpon*, concerning the occurrence of rhizocarpic acid. In *Lecanora*, however, some subgeneric entities are characterized by the cortical substance, e.g. the *Lecanora allophana* - group by the presence of atranorin (BRODO 1984: 88). How problematic a generic concept based mainly on chemical characteristics can be, becomes clear for example in the *Lecanora marginata* - group, comprising species with usnic acid, species with atranorin and even species containing both substances (as does *Lecanora marginata* itself).

In several studies of lecideoid lichens, HERTEL used the pigmentation of excipulum and/or hypothecium as an important character to di-

stinguish genera or - according to the concept - subgenera. A black brown "carbonized" exciple obviously developed independently within several groups within different families, such as in the Lecanoraceae, the Porpidiaceae and the Tremoleciaceae. The genus *Carbonea* for example, was originally defined by the presence of a carbonized exciple (HERTEL 1967, 1983, 1984). In this study and in KNOPH & RAMBOLD (in prep.) a different concept of this genus is proposed, based on structural qualities of the paraphyses and the asci. Within the Porpidiaceae, the pigmentation of the hypothecium seems to be of some value in the generic delimitation of *Poeltiaria*, a genus restricted to the Southern Hemisphere.

The type of margination and the degree of immersion of the apothecia have been regarded as important generic characteristics by several authors. However, there are several families with genera showing rather variable margination. They all comprise species with either lecanorine or lecideine (biatorine) margination, e.g. the Fuscideaceae (*Fuscidea*), the Lecanoraceae (*Lecanora*, *Protoparmelia*, *Tephromela*), the Porpidiaceae (*Amygdalaria*), the Trapeliaceae [= Agyriaceae] (*Trapelia*) (HERTEL & RAMBOLD 1985: 496, HERTEL 1987a: 227, fig. 6). This is also known in groups other than lecideoid lichens, e.g. the Teloschistaceae (*Caloplaca*) (POELT & WUNDER 1967).

Spore, ascus, paraphyses, and conidia structures, and to a certain degree ecological and phytosociological behaviour (WIRTH 1982), seem to represent the most important genus characters.

The species concept of lecideoid lichens differs between the various genera. In most genera of the Lecanoraceae, Lecideaceae and Porpidiaceae the species have been separated mainly by combinations of these three characters: a) the inner and outer pigmentation of thallus and apothecia; b) amyloid reactions in medulla and hymenium (hymenial gel and outer ascus wall); c) the "chemistry", i.e. the production of specific secondary compounds.

"Difficult" genera, like *Trapelia* or part of *Miriquidica*, are rather uniform in these characters and there it seems necessary to rely more upon morphological and ecological characters. In this study, units which are identical anatomically, which show a similar distribution and ecological behaviour and differ only chemically, are treated as "chemotypes" without any taxonomic rank. This is the case e.g. with *Paraporpidia leptocarpa* which has two chemotypes. Varieties are regarded as units which are anatomically equal, but differ chemically and ecologically (or in their distribution, as e.g. with *Porpidia albocaerulescens*). A similar case is that of *Lecidea ochroleuca* and *L. terrena*. These two taxa are anatomically almost identical, and are distinguishable only chemically. They differ to a certain degree in their distribution and their substratum preference. For this reason, they are regarded as two different species.

For further general aspects concerning chemical variation and species concepts see BRODO (1986).

3.2. The lecideoid genera occurring in continental Australia

So far, thirty-two of the sixty accepted genera comprising lecideoid lichens have been found in Australia (tab. 1). Twenty-two genera are dealt with in this study. The following ten genera have been excluded for

Table 1. The lichen genera with lecideoid type species and the accepted genera comprising lecideoid species – arranged according to the year of description [**bold**: accepted names; underlined: occurring in Australia; asterisks *: occurring in Australia, but not treated in this study].

1796	<u>Psora</u> Hoffm.*	
1803	<u>Lecidea</u> Ach.	
1809	<u>Lecanora</u> Ach.	
1809	<i>Biatora</i> Ach. nom. rejic. prop.	= <i>Stenhammarella</i>
1817	<u>Biatora</u> Fr.	
1825	<u>Micarea</u> Fr.	
1825	<u>Zeora</u> Fr.	= <i>Lecanora</i>
1853	<i>Amygdalaria</i> Norm.	
1855	<u>Lecidella</u> Koerb.	
1855	<u>Porpidia</u> Koerb.	
1855	<u>Pyrrophospora</u> Koerb.	
1855	<u>Schaereria</u> Koerb.	
1855	<i>Stenhammara</i> Koerb. [nom. illegit.]	= <i>Stenhammarella</i>
1857	<u>Pilophorus</u> Th.Fr.*	
1857	<i>Placolecis</i> Trev.	
1858	<i>Astroplaca</i> Bagl.	= <i>Placolecis</i>
1860	<i>Helocarpon</i> Th.Fr.	
1860	<u>Psilolechia</u> Massal.	
1868	<u>Rimularia</u> Nyl.	
1873	<i>Stelma</i> Koerb.	
1874	<u>Orphnosporea</u> Koerb.*	
1887	<i>Aphanopsis</i> Nyl. ex Sydow	
1898	<u>Miltidea</u> Stirt.*	
1911	<u>Protoblastenia</u> (Zahlbr.) Steiner*	
1912	<u>Saccomorpha</u> Elenk.*	
1929	<u>Protoparmelia</u> Choisy*	
1929	<u>Tephromela</u> Choisy	
1929	<u>Trapelia</u> Choisy*	
1930	<i>Huillia</i> Zahlbr.	= <i>Amygdalaria</i>
1934	<i>Placynthiella</i> Gyel.	= <i>Saccomorpha</i>
1936	<i>Haplocarpon</i> Choisy	= <i>Porpidia</i>
1940	<i>Cladopycnidium</i> H.Magn.	= <i>Lecidea</i> subg. <i>Cladopycnidium</i>
1950	<u>Peltiphylla</u> Choisy	= <i>Psora</i>
1951	<i>Chrysopsora</i> (Vain.) Choisy	
1953	<u>Hypocenomyce</u> Choisy*	
1953	<u>Tremolecia</u> Choisy	
1955	<u>Eremastrella</u> S.Vogel*	
1965	<i>Lecideomyces</i> Clf. & Tom. [nom. illegit.]	= <i>Adelolecia</i>
1967	<i>Stenhammarella</i> Hertel	
1972	<u>Fuscidea</u> V.Wirth & Vězda*	
1976	<i>Vezdaea</i> Tschermack-Woess & Poelt	
1977	<u>Heppsoara</u> Awasthi & Singh	= <i>Tephromela</i>
1980	<i>Apatoplace</i> Poelt & Hafellner	
1980	<i>Hertelliana</i> P.W.James	
1980	<i>Psorinia</i> G.Schneider	
1980	<i>Psorula</i> G.Schneider	
1980	<i>Trapellopsis</i> Hertel & G.Schneider	
1980	<i>Xanthopsora</i> G.Schneider & W.A.Weber	
1981	<i>Lecidoma</i> Schneider & Hertel	
1981	<u>Melanolecia</u> Hertel	
1981	<u>Tylothallia</u> P.W.James & Killas	
1983	<u>Carbonea</u> (Hertel) Hertel	
1983	<i>Farnoldia</i> Hertel	
1984	<i>Adelolecia</i> Hertel & Hafellner	
1984	<u>Austroolecia</u> Hertel	
1984	<i>Bahianora</i> Kalb	
1984	<i>Clauzadea</i> Hafellner & Bellemère	

1984	<u>Clauzadeana</u>	Roux	
1984	<u>Diomedella</u>	Hertel	= <i>Lecanora</i>
1984	<u>Elglera</u>	Hafellner	
1984	<u>Hafellnera</u>	Houmeau & Roux	
1984	<u>Lambiella</u>	Hertel	= <i>Rimularia</i>
1984	<u>Notolecidea</u>	Hertel	
1984	<u>Nothoporpidia</u>	Hertel	= <i>Lecidea</i>
1984	<u>Poeltiaria</u>	Hertel	
1984	<u>Poeltidea</u>	Hertel & Hafellner	
1984	<u>Pseudolecidea</u>	Clauzade & Roux [nom. illegit.]	= <i>Clauroxia</i>
1984	<u>Rhizolecia</u>	Hertel	
1984	<u>Stephanocyclos</u>	Hertel	
1984	<u>Xenolecia</u>	Hertel	
1984	<u>Zosterodiscus</u>	Hertel	= <i>Lecidea</i>
1985	<u>Cephalophysis</u>	(Hertel) Killas	
1987	<u>Miriquidica</u>	Hertel & Rambold	
1988	<u>Clauroxia</u>	D.Hawksw.	
1988	<u>Schizodiscus</u>	Brusse	
1989	<u>Immersaria</u>	Rambold & Pietschmann	
1989	<u>Paraporpidia</u>	Rambold & Pietschmann	

several reasons: *Eremastrella*, *Hypocenomyce* and *Psora* (with psoroid growth form), *Fuscidea* and *Protoblastenia* (scarce material), *Trapelia* (Extra-Australian material not known sufficiently), *Miltidea*, *Saccomorpha* (= *Placynthiella*) (no saxicolous species found), *Pilophorus* (no crustose species known from Australia) and *Orphniospora* (data of Australian material already published in HERTEL & RAMBOLD 1988b).

3.3. Morphology and anatomy

For macrolichens mostly morphological and chemical features are used as main diagnostic characteristics, whereas for crustose lichens mainly chemical and anatomical characters are used. Suitable methods for the cultivation of saxicolous crustose lichens do not exist and are not anticipated. Thus, it mostly remains unclear, as to what degree a character is fixed genetically and to what degree it is influenced by environmental factors.

3.3.1. Environmental modificative factors

In saxicolous lecideoid lichens the following environmental factors are likely to be very important:

a) Chemical and physical qualities of the substrate

The chemical qualities of the substrate can modify the appearance of crustose lichens generally and of lecideoid lichens also. In so called chalcophilous lichen species, the normally whitish to greyish coloured thallus becomes yellowish, ochraceous to deep red or "rusty colour-

red", when growing on cupriferous or iron-rich rocks. The colour is caused by the accumulation of particles from the heavy metal compounds in the cortex layer (LANGE & ZIEGLER 1963, SCHWAB 1986, PURVIS & al. 1987). Only few obligatorily rusty coloured species are known, e.g. *Tremolecia atrata*, which also occurs in Australia.

Because of the close contact of the thallus and apothecia of crustose lichens with the substrate, the surface structure of the substratum plays an extraordinary role in their morphological appearance. For example areoles and apothecia growing on coarsely grained sandstone often are very irregularly shaped.

Another important factor is the capability of the substrate to expand and contract under various conditions of hydration. This influences the degree of fissuring in the thallus and, consequently effects the size of areoles to a certain extent.

b) Inclination and exposure of the substrate

The inclination of the substratum and the exposure to light determine the microclimatic conditions under which a lichen grows. The modifications caused by these factors are mainly colour differences. Specimens growing in a sheltered location are exposed to lower intensity of light and for this reason are often less colourful than specimens growing in an exposed location. This is caused by a minor degree of pigmentation of the thallus cortex, excipulum or epihymenium or by a minor production of cortical lichen substances (RICHARDSON 1967, LAWREY 1986). In species growing in dusty arid areas in an exposed location, the accumulation of sand particles between the areoles, on the discs of the apothecia, and in the cortical zone also changes the general colour impression, e.g. in *L. ochroleuca*, which typically develops white to whitish-grey areoles and often becomes sandy coloured when growing on soil. Specimens growing in sheltered humid habitats are occasionally colonized by green or blue-green algae, which changes the colour of the lichen thallus from white to dirty brown (e.g. in *Poeltiaria turgescens* or *Porpidia albocaerulescens*). The tendency to develop slightly stipitate apothecia, is observed in specimens of some crustose genera growing on overhanging rock surfaces, e.g. species of *Protoparmelia* or *Tephromela*.

c) Nutrition

Nitrophilous saxicolous species (e.g. several species of *Lecidella*) prefer growing on exposed rocks, on which birds manure. Such ornithocoprophilous lichens often develop luxuriant thalli when they find good nutritive conditions. Otherwise they are more or less poorly developed.

d) Damage by animals and fungal parasites

Crustose lichens are food and habitat for several groups of animals and fungal parasites. Specimens damaged by snails or caterpillars or infected by fungi are found in most lecideoid lichen genera. The type of damage depends on the various type of animal and fungus. Snails erode lichen thalli superficially; however subsequent damage may destroy the thallus completely. Damage caused by caterpillars can be recognized by the prints of the mandibulae and the typical form of the faeces. For further details see GERSON & SEAWARD (1977) and

RAMBOLD (1985). The types of modifications caused by fungal parasites (e.g. gall infections or general destruction) are documented by TRIEBEL & RAMBOLD (1988) and TRIEBEL (in press).

e) Water

As mentioned above, specimens growing in humid habitats are readily colonized by algae. Specimens growing on rocks, which are seasonally inundated by streaming water, often have apothecia, that are completely immersed into the thallus (e.g. *Porpidia albocaerulescens*).

3.3.2. Thallus morphology

Lecideoid lichens have crustose thalli, which differ in various ways. The diameter of the thallus depends on the age of the specimen and on environmental factors. This is obvious in species which prefer colonizing bare rocks and which behave as pioneers, e.g. *Paraporpidia leptocarpa*, occasionally develop very large thalli. Species with mostly small thalli occur in genera like *Clauzadeana*, *Rimularia*, *Tremolecia*, which grow in more advanced cryptogamic associations.

Species with the thalline hyphae hidden between the fissures of the substrate surface, e.g. between the crystalline particles, are called cryptothallin. This growth type occurs in various lecideoid genera, such as *Lecidea* (*L. sarcogynoides*) or in *Carbonea* (*C. vorticosa*). Calcicolous species can develop a so-called endolithic thallus, which grows below the surface of the substrate, e.g. some species of *Farnoldia* or *Lecidella*.

In euthalline species, the thallus shows a number of important diagnostic characters. The colour of the cortex ranges from white to yellow, grey to dark brown depending on the degree of incrustation of lichen substances, the development of pigmentation or the degree of accumulation of iron or copper compounds respectively. The deposition of cortical lichen substances (e.g. atranorin, rhizocarpic acid, usnic acid, norstictic acid or xanthonen) causes white, creamy white to yellow colours. This is the case in many species of the Lecanoraceae, but also in species of the Porpidiaceae and Lecideaceae. The brown and black colour of areoles in some species is caused mainly by the pigmentation of the distal cells in the cortical layer. The chemical nature of these pigments has not yet been clarified for these lichens. The pigments are probably products of oxidative coupling of phenols derived from polyketides, as shown in WHEELER (1983) for some ascomycetes. Among the lecideoid genera occurring in Australia, such cortical pigments are observed in *Clauzadeana* (*C. macula*), *Immersaria* (*I. athroocarpa*), *Lecidea* (e.g. *L. atrobrunnea*, *L. atromorio*), *Miriquidica* (*M. deusta*), *Orphniospora* (*O. moriopsis*), *Poeltidea* (*P. perusta*), *Protoparmelia* (e.g. *P. badia*), and *Rimularia* (e.g. *R. exigua*, *R. insularis*).

A lecideoid species occurring in Australia, which obligatorily accumulates iron oxides in the thalline cortex and has a dark red to red thallus, is *Tremolecia atrata*. Facultatively rusty coloured thalli have been found in *Lecidea* (e.g. *L. fuscoatrula*, *L. lapicida*, *L. lygomma*, *L. sarcogynoides* s.l. and *L. terrena*) and in *Porpidia* (*P. crustulata*, *P. macrocarpa*, and *P. umbonifera*).

The size of the areoles often is of no value as a diagnostic character. Some species, however, show relatively extreme sizes, e.g. *Clauzadeana macula*, with very small areoles (0.2 - 0.3 mm av. diam.), or *Poeltiaria coromandelica*, with areoles reaching 3 mm in diam. The shape of the areoles shows characteristic differences between the species, but is often strongly modified by environmental factors. Rounded and sublobate areoles are found in specimens with a dispersed-areolate thallus, while they are angular to irregularly shaped in specimens with rimose-areolate to regularly areolate thalli. Within the genus *Lecanora* undulating margins of areoles are common, however they are not developed constantly, e.g. in *L. impressa*.

The thickness of the thallus, i.e. the height of the areoles, is extremely variable within most species. In some genera, typically cryptothalline species occasionally develop euthalline specimens and vice versa, e.g. *Lecidea sarcogynoides* or *L. lapicida* respectively. Most of the species dealt with in this study always show a well developed thallus of varying thickness. Within the Australian species the thickest thalli were found in *Poeltiaria coromandelica* (up to 1.5 mm) and *Tephromela armeniaca* (up to 2 mm).

Areoles are mostly plane initially but in many species later become more or less convex. Concave areoles were found only in *Immersaria athroocarpa* and occasionally in *Lecidea fuscoatrula*. The surfaces of old areoles often are altered by cracks or wrinkles. The impression of a rough or smooth areole surface mostly depends on the development of an epinecral layer, which also gives the impression of a white margin to the areoles in species with a brown pigmented cortical layer.

Soralia are uncommon in lecideoid lichens and known in a few species only. Among the Australian species dealt with in this study only one species of the Lecanoraceae (*Biatora sorediosa*) and one of the Porpidiaceae (*Porpidia soredizodes*) showed this character. Isidia are known only from some non-Australian lecideoid species of the Rimulariaceae (HERTEL & RAMBOLD in press). Cephalodia are developed in lecideoid lichens in several species of the genera *Micarea* and *Amygdalaria* and in a crustose representative of *Pilophorus* (*P. dovrensis*).

Pycnidia were observed in most lecideoid species, but they were mostly difficult to find. Because of their small size, they are easily overlooked, especially in inconspicuous cryptothalline species. In all species they are more or less immersed in the thallus, mostly in the zone close to the growth front.

The development of a hypothallus varies greatly within genera and even differs within species. It is mostly coloured dark grey to black and is visible between the areoles or at the thallus margin. RUNEMARK (1956) and SCHWAB (1986) assumed that the hypothalline tissue generally was better developed in specimens from higher altitudes and latitudes growing under extremely cold conditions, than in those that grew under less extreme conditions. This was not observed in material derived from continental Australia, as the Australian continent has no extremely high mountainous areas and only reaches the 39 °S.

3.3.3. Thallus anatomy

Cortical layer

In most euthalline lecideoid species a distinct cortical layer is developed. Ecorticate thalli are found only in few species, e.g. *Psilolechia lucida*. The cortical layer can be divided into three zones; one or two of these are often missing. The basal zone, immediately above the algal layer, is built up of interwoven conglutinated hyphae, mostly c. 3 - 5 μm thick. In this unpigmented part of the cortex cortical lichen substances may be deposited. In species with a brown or grey coloured thallus, the cortex is confined by a pigmented zone above. The colour of the cortical pigmentation may or may not be identical with that of the outer excipule and the epihymenium pigmentation or not. In lichen groups with a more complex thallus organization, e.g. in psoroid genera as *Psora* or *Phyllopsora*, the texture of the cortical hyphae is regarded as an important characteristic of genera or species (COPPINS 1983: 22; SCHNEIDER 1980: 18 - 20; SWINSCOW & KROG 1981; TIMDAL 1984b), while in most crustose lichens, including lecideoid genera, this feature, being less differentiated, has not been regarded as taxonomically relevant (e.g. BRODO 1984: 71; HERTEL 1987a).

Some species have been found to develop a relatively thick epinecral layer above the pigmented zone of the cortex. The epinecral layer is built up of dead cortical hyphae and forms a compact, mostly hyaline layer, which may be up to c. 100 μm thick. Within lecideoid lichens, this character is regarded as genetically fixed and diagnostically important. Species with thalli of the "*Lecidea atrobrunnea* -type" (sensu HERTEL 1977) show a thick epinecral layer above a brown pigmented upper cortical zone. Macroscopically the areoles of these lichens are nitid brown and more or less white at the margins. The white colour impression is caused by total light reflection within the epinecral zone. This type of light protection is observed in alpine species as well as in species of lower altitudes e.g. in the alpine *Clauzadeana macula*, *Immersaria athroocarpa*, *Lecidea atrobrunnea* and *Poeltidea perusta*; and in the lower altitude species *Lecidea atromorio*, *L. capensis*, *L. fuscoatrula*, and *L. tragorum* (see also tab. 6 (p. 90), tab. 7 (p. 126), tab. 9 (p. 163), tab. 11 (p. 234)).

Medullary layer

The medullar layer also can be divided into three main zones: a) the algal layer, b) the medulla itself and c) the basal "cortex", a zone of undifferentiated compact hyphae in direct contact with the substrate, which has been observed only occasionally in some species.

The algal layer is more or less contiguous and varies greatly in height. The photobionts of lecideoid lichens by definition belong to the Chlorophyta and they obviously are taxonomically highly valuable. As indicated in HERTEL (1987a: 228 - 229, tab. 1), lecideoid species of various genera contain different photobionts. In this study, the identification of the algal species or genus has not been attempted for lack of experience.

The medulla is not pigmented in most genera. In *Clauzadeana*, *Orphniospora* and *Rimularia*, however, the medullary hyphae show a brown to

dark brown pigmentation (HERTEL & RAMBOLD 1988b: 119). The medulla reaction in iodine solution ("I") is an important character in many lichen groups. In lecideoid lichens, the amyloidity of the medulla can be regarded as a valuable species character (tab. 9 (p. 163), tab. 11 (p. 234)). An amyloid medulla frequently occurs in the Lecideaceae and Porpidiaceae, where it reacts I+ violet or blue. In *Paraporphidia glauca*, the amyloidity of the medulla is very variable, as specimens either show a strong or only a pale or no medulla reaction. Among the other families treated here, an amyloid medulla is characteristic for *Rimularia* (e.g. *R. psephota*) and for some species of *Lecanora* (e.g. *L. impressa*) and *Lecidella* (e.g. *L. entero-leucella*). In the Lecanoraceae the colour impression of the reaction is violet-brown to brown. A pale blue medullary reaction was occasionally found in *Poeltiaria*. Amyloid reactions are also observed in the medullary zone of the excipulum.

3.3.4. Apothecia morphology

The margination of the apothecia depends on the development of an excipulum. In most lecideoid genera a tendency towards reduction of the excipula is observable (see POELT 1987).

The following main types of apothecia occur in lecideoid genera: a) immersed, showing no margination, e.g. *Lecanora impressa*, *L. oreinoides* (fig. 9); b) immersed, surrounding areole forming an irregular "thalline" margin, e.g. *Poeltidea perusta*, several forms of *Schaereria fuscocinerea* (fig. 28); c) immersed, with thin margination, e.g., *Immersaria athroocarpa*, *Lecanora demersa*, *Lecidea atromorio*, *Miriquidica deusta* (fig. 7, 11); d) subimmersed to sessile, showing no distinct margin, e.g. *Protoparmelia petraeoides*, lecideoid forms of *Tephromela atra*; e) subimmersed to sessile, showing a distinct margin, e.g. most species of *Lecidea*, *Rimularia* (fig. 16); f) sessile, showing a "lecanorine", or so-called "thalline" margin, e.g. lecanoroid forms of *Tephromela arafurensis* (fig. 13) and *T. atra*.

Most of the species of *Lecidea* and the Porpidiaceae have black or brown apothecia. In the Lecanoraceae species with a brown (*Protoparmelia badia*), red-brown (*Protoparmelia petraeoides*) or red disc (*Pyrrospora sanguinolenta*) are known as well as black ones such as in *Lecidella*. A creamy coloured disc is known from *Biatora* (*B. sorediosa*) and a yellow one from *Psilolechia* (*P. lucida*). The overall colour of the apothecia is mostly determined either by the pigmentation of the epihymenium or, as in *P. lucida*, by the incrustation of coloured lichen substances. The discs of *Paraporphidia leptocarpa* and rarely of *Poeltiaria turgescens*, may develop an intense red pruina from accumulated iron oxide particles. Discs with whitish to grey pruina are found in various species of the Lecanoraceae (e.g. *Lecanora marginata*), the Lecideaceae (*Lecidea sarcogynoides*) and the Porpidiaceae (e.g. *Porpidia albocaerulescens*). In most lecideoid species, the margin, if developed, is the same colour as the disc.

The size of the apothecia varies in the same way as the size of the areolae and is a valuable diagnostic characteristic at the species level only in very few cases.

3.3.5. Apothecia anatomy

Excipulum:

The most striking characteristics of the excipulum in lecideoid lichens are: a) the degree of development of an "amphithecium" (i.e. the ectal zone of the excipulum), b) the type of pigmentation of the outer and inner zone, c) the presence of algal cells and, d) the development of a medullary zone.

An important characteristic at the species level (e.g. in *Porpidia*) is the breadth of the hyphae and the width of the lumina of the hyphae (ANDERSON 1964, HERTEL & KNOPH 1984, SCHWAB 1986, HERTEL & RAMBOLD 1987).

In former generic concepts (e.g. of ZAHLBRUCKNER 1925) the following four main types of exciple or apothecium margination respectively, based on the characters mentioned above, have been distinguished: species with reduced margin and immersed apothecia have mostly been placed in *Aspicilia*, species with a developed excipulum, containing algal cells, in *Lecanora*, species with a strongly or faintly pigmented excipulum, without algal cells, in *Lecidea* or in *Biatorea*. As shown in HERTEL & RAMBOLD (1985) and HERTEL (1987a), these excipulum types have developed independently in various groups.

Reduced margins, or reduced excipula, are found in species with immersed, "aspicilioid" apothecia. Within the Lecanoraceae, this type of apothecia is found in *Lecanora* (incl. *Diomedella*), *Miriacidia*, and in *Tephromela*; within the Porpidiaceae in *Amygdalaria*, *Immersaria*, and in *Porpidia*. Immersed apothecia often show parts of the amphithecium, e.g. in *Immersaria athroocarpa* or in *Lecanora demersa*; a thin margination is observable in such cases. In species with no prominent structure at the lateral parts of the hymenium, the apothecia appear completely immersed and immarginate, e.g. in *Lecanora impressa* and *L. oreinoides*.

"Biatorine" apothecia, with poorly pigmented excipula, lacking algal cells, are found mostly in *Fuscidea*, *Lecanora*, *Micarea*, and *Tephromela*. The "lecanorine" type is not only represented in the Lecanoraceae (e.g. in *Lecanora*, *Protoparmelia* or *Tephromela*), but also in the Porpidiaceae (e.g. in *Koerberiella*). A lecideine margination is developed in all "lecideoid" genera. Extremely dark pigmented excipula are called "carbonized". The carbonization of the excipulum has developed independently in various families in the lecideoid species, e.g., in the Lecanoraceae (*Carbonia*), the Lecideaceae (*Cecidonia*, *Melanolecia*), the Porpidiaceae (*Farnoldia*), and in the Tremoleciaceae (*Tremolecia*). All these excipulum types, mostly differing in the pigmentation, the presence or absence of a medullary layer and of algae, can be regarded as homologous, as it has been pointed out by MOSER-ROHRHOFFER (1960), LETROUT-GALINO (1966) and EIGLER (1969). The main excipulum characteristics developed by the genera treated in this study are given in table 2.

Table 2. The main excipulum characteristics (development of an amphithecium, inner and outer pigmentation, presence of algal cells, development of a medullary zone) and their distribution in Australian lecideoid species [bl = black; br = $\pm$ brown; cl = colourless; d = dark; gr = $\pm$ green; gre = grey; or = orange; r = red; vio = violet].

	amphith.	outer pigm.	inner pigm.	alg.	med.
Catillariaceae					
<i>Austrolecia</i>	+	d gr	gre - gr	-	-
Lecanoraceae					
<i>Biatora</i>	+	gre, gr, cl	gre cl	$\pm$	$\pm$
<i>Carbonea</i>	+	gre, br, or	gre, d br	-	-
<i>Clauzadeana</i>	$\pm$	gre-br	cl	+	+
<i>Lecanora</i>	$\pm$	d gr, cl	cl	$\pm$	$\pm$
<i>Lecidella</i>	+	d gre, gr, br	cl, gre, br, or	$\pm$	$\pm$
<i>Miriquidica</i>	+	d gr	gre, cl	-	$\pm$
<i>Protoparmelia</i>	+	cl, br	cl, br	$\pm$	$\pm$
<i>Pyrrhospora</i>	+	or-r	or-r, cl	-	-
<i>Tephromela</i>	$\pm$	cl, gre-gr	cl, gre-gr	$\pm$	$\pm$
<i>Tylothallia</i>	+	gr, bl	gre, cl	-	-
Lecideaceae					
<i>Lecidea</i>					
subg. <i>Lecidea</i>	$\pm$	gre, bl, gr-br	cl, gre, br, vio	-	$\pm$
subg. <i>Rehmiopsis</i>	$\pm$	gre, bl, gr-br	cl, gre, br	-	$\pm$
Micareaceae					
<i>Micarea</i>	+	gre	cl	-	-
<i>Psilolechia</i>	$\pm$	cl	cl	-	-
Porpidiaceae					
<i>Immersaria</i>	$\pm$	d br, gre	cl, br	-	+
<i>Paraporpidia</i>	+	d br, gre-br	cl, gre, d br	-	$\pm$
<i>Poeltiaria</i>	+	br, gr, bl	cl, br, gre	-	-
<i>Poeltidea</i>	-	br, -	cl, -	+	+
<i>Porpidia</i>	$\pm$	br, bl	cl, br, d br	-	$\pm$
Rimulariaceae					
<i>Rimularia</i>	+	d br	cl, d br	-	$\pm$
Schaereriaceae					
<i>Schaereria</i>	$\pm$	gr, gre, br	cl	$\pm$	+
Tremoleciaceae					
<i>Tremolecia</i>	+	d br	br	-	+

Subhymenial zones:

The subhymenial zones are divided by several authors (HERTEL 1967, SIPMAN 1983, SCHWAB 1986) into two main layers: the subhymenium and the hypothecium. The subhymenium is the zone between the hymenium, defined by the base of the asci, but not yet collapsed asci, and the hypothecium below. It is built up by the basal parts of the paraphyses and by the ascogenous hyphae. The cell lumina of the ascogenous apparatus are mostly readily stainable with cotton blue. A basal delimitation of the subhymenium is only determinable in species with a pigmented hypothecium, while in species with unpigmented hypothecia only the thickness of the layer containing the ascogenous hyphae, which partly belong to the hypothecium, is measurable.

The subhymenium usually shows a similar, slightly stronger pigmentation than the hymenium, e.g. in *Lecidea atromorio*, *L. fuscoatrula* and *L. sarcogynoides*, with a reddish hymenium or in *L. atrobrunnea*, *L. ochroleuca* and *L. terrena*, with a greenish hymenium. A pale brownish subhymenium is found in several species of *Lecidella*, which is caused by the hypothecial pigmentation reaching up to the basal part of the hymenium. An unpigmented subhymenium, however, is much more frequent in lecideoid lichens. The thickness of the subhymenium is rather variable, both within and between the different species and genera, ranging mostly between 10 and c. 25 μm (up to 40 μm). An extreme variability in the height of subhymenium is found in the Porpidiaceae, (e.g. in *Paraporpidia leptocarpa* it is between 30 and 120 μm tall).

The pigmentation of the hypothecium is a very important diagnostic character at the species as well as at the generic level, e.g. for the delimitation of *Poeltiaria* (HERTEL 1984). Only few species show a high variability of the hypothecium colour, e.g. in *L. lapicida* in range from colourless, pale brown to dark brown. The height of the pigmentation is extremely variable and partly depends on the age of the apothecium. In some representatives of the Lecanoraceae (e.g. in several species of *Lecidella*), collapsed asci may be observed even in the basal zone of the hypothecium of adult apothecia, which suggests that old hymenial tissue is resorbed there.

Hymenium:

The zone between the base of the asci and the tips of the paraphyses is defined as the hymenium. Hymenial characters are length, form, septation, pigmentation and structure of the paraphyses, and the amyloid reactions of the hymenial gel between the paraphyses and of the ascus wall.

An important diagnostic feature on species level is the height of the hymenium. Its variability in cryptothalline lecideoid species is demonstrated in HERTEL (1975b: 41). The upper part of the hymenium, formed by the apices of the paraphyses, is called the epihymenium. The colour of the epihymenium is relatively constant within species. Within lecideoid lichens it ranges from black, dark green, brown to orange-red or pale yellowish. Most common in the Lecideaceae and Porpidiaceae is a greenish to brownish pigmentation. In older apothecia of species with a typically green epihymenium, the colour of the pigmentation may become

brownish tinged or even completely brown. An incrustation of the epihymenium by coloured lichen substances can be observed e.g. in several species of the Lecanoraceae (*Lecanora*, *Pyrrhospora*) or of the Micarea-ceae (*Psilolechia*).

Violet granules of unknown chemical nature, mostly observable in the upper zone of the hymenium, are found in *Rimularia psephota* and in *Schaereria fuscocinerea*. The granules show a typical reversible pH-dependant reaction from red-violet in HCl to blue-green in KOH. (The diffuse epihymenial pigmentation of *Sch. fuscocinerea* turns from blue-green in HCl to green in KOH). Similarly coloured particles are also known from the lichenicolous fungi *Dactylospora diminuta* (Th.Fr.) Triebel and *D. lobariella* (Nyl.) Hafellner, however they occur mainly in the hypothecium (TRIEBEL in press).

The middle and basal zone of the hymenium is pigmented only in few lecideoid species. Several species of *Lecidea*, especially in subg. *Lecidea*, show a reddish (*L. atromorio*, *L. fuscoatrula*) or greenish (*L. ochroleuca* agg.) tinged hymenium. An identical colour zonation of the hymenium and the excipulum is observed in *L. sarcogynoides* with its black epihymenium and ectal zone of excipulum, a violet-brown hymenium (incl. subhymenium) and inner zone of excipulum, and a dark brown hypothecium and "parathecium" respectively. Within the Lecanoraceae, a conspicuous pigmentation of the hymenium is observed in the genera *Carbonea* and *Tephromela*. In most species of *Carbonea*, e.g. *C. vorticosa*, the green colour of the epihymenium "radiates" into the basal parts of the hymenium. In some species of *Tephromela*, the pigmentation of the epihymenial and the lower hymenial zone is different: the epihymenium shows a black-brown colour, while the basal zones of the hymenium are violet to violet-brown. The pigmentation of the hymenium is regarded as a suitable diagnostic feature in several genera, but is not always easily discernable. For the iodine reaction of the hymenium see under "Asci".

Paraphyses:

The structure of the paraphyses (thickness of the wall, width of the lumen, septation, degree of branching or anastomosing and form and breadth of the apical cells) and the pigmentation of the paraphyses (forming apically the epihymenial coloration and beneath the hymenial coloration), are highly specific characters at the species and generic level.

In most genera the paraphyses are c. 1.5 - 2.5 μm thick. Thick-walled paraphyses, exceeding a breadth of 2.5 μm and reaching up to 10 μm , occur in only a few lecideoid lichen genera e.g. in *Tephromela*. However in this genus, this character is quite variable. The walls of this type of paraphyses can be interpreted as being composed of two layers: a "proper" inner wall layer and an outer gelatinous sheath. An outer gelatinous wall layer probably is developed in both thick-walled and thin-walled paraphyses, but only much lesser in the latter. For this reason the author regards thick-walled paraphyses with gelatinous sheaths as not being structurally fundamentally different from thin-walled paraphyses without distinct gelatinous sheaths.

Paraphyses with somewhat thickened apical cells are seen in most lecideoid genera. Extreme examples are found in the genus *Cephalophy-*

sis (Teloschistaceae) and in several species of *Clauzadea* (Porpidiaceae). (Neither genus is known from continental Australia). Highly anastomosing paraphyses are usually not thickened apically, as can be observed e.g. in some species of *Rimularia* (Rimulariaceae) or in *Tremolecia* (Tremoleciaceae).

The width of the lumina of the paraphyses rarely exceeds c. 1 μ m in lecideoid genera, and only in few cases it is a valuable diagnostic feature. TRIEBEL & RAMBOLD (1988) used it as one of several characters distinguishing the genera *Phacopsis* Tul. emend. Koerb. and *Carbonea* (Hertel) Hertel, both genera of the Lecanoraceae comprising parasymbiotic species.

The degree of the septation in single paraphyses is difficult to observe and for this reason has not been used for the characterization of either species or genera in this study.

The degree of branching and anastomosing of the paraphyses is a diagnostically significant feature, but it is rather difficult to quantify. Highly anastomosing (and branching) paraphyses occur in most lecideoid families: in the Lecanoraceae (*Clauzadeana*), the Micareaceae, the Porpidiaceae (e.g. in *Amygdalaria*, *Immersaria*, *Porpidia*, *Poeltiaria* and *Poeltidea*), the Rimulariaceae (*Lithographa*, *Rimularia*), the Agyriaceae s.l. (*Saccomorpha*, *Trapeliopsis*) and the Tremoleciaceae (*Tremolecia*). Mostly simple paraphyses are found among the Lecanoraceae e.g. in *Lecidella* and in the Schaereriaceae and also the Agyriceae (*Trapelia*). Most of the species of the remaining genera (e.g. *Lecanora*, *Lecidea*) have intermediate types of paraphyses with regard to branching and anastomosing.

Asci:

The asci and the ascogenous hyphae represent the dikaryotic generation of the mycobiont. They show characters, which are relevant diagnostically at the generic, family and order levels, but, in some cases, they are also suitable for the characterization of subgeneric entities. The size of the asci correlates with the height of the hymenium and with the spore size and for this reason represents a specific or generic character.

The iodine reaction of the "hymenial gel", (i.e. the ascus gelatine embedded between the paraphyses), with Lugol's solution is a valuable diagnostic characteristic at the generic or subgeneric level. Its intensity depends on the concentration of the solution. In low concentration [I], it causes a bluish reaction in nearly all lecideoid lichens. In high concentrated solution [Iconc.], the reactions differ between species, genera and even families. *Schaereria* or *Trapelia* mostly show no iodine reaction of the hymenium at all. Most of the genera in the Lecanoraceae react I $\pm$ bluish, but Iconc. -. An Iconc. + reddish reaction, which BARAL (1987) calls a "hemiamyloid" reaction, has been observed in species of the Micareaceae, in several genera of the Porpidiaceae, the Rimulariaceae, Tremoleciaceae and in *Lecidea* subg. *Lecidea*. In some genera of the Porpidiaceae and in *Lecidea* subg. *Rehmiopsis*, the hymenium is "euamyloid", reacting Iconc. + blue. As already indicated in TRIEBEL & RAMBOLD (1988), older specimens of species, typically showing an I conc. + red reaction of

hymenium (and ascus wall), react I_{conc.} + blue. This effect was particularly noticable in specimens of *Lecidea* subg. *Lecidea*, which were collected in the last century.

Table 3. Amyloid reactions of the hymenial gel, the outer ascus wall [in I_{conc.}], and the medullary layer [in I] as observed in genera with lecideoid species. (The data are based only on Australian lecideoid representatives.)

	Hym. I _{conc.}	Ascus wall I _{conc.}	Med. I
Catillariaceae			
<i>Austrolecia</i>	-	red-brown	-
Lecanoraceae			
<i>Biatora</i>	-	red-brown	-
<i>Carbonea</i>	-	-/brown	-
<i>Clauzadeana</i>	-	red-brown	-
<i>Lecanora</i>	-	brown	-/viol.br.
<i>Lecidella</i>	-	red-brown	-/viol.br.
<i>Miriquidica</i>	-	(red-)brown	-
<i>Protoparmelia</i>	-	± brown	-
<i>Pyrrhospora</i>	-	± bluish	-
<i>Tephromela</i>	± blue	brown	-
<i>Tylothallia</i>	± blue	brown	-
Lecideaceae			
<i>Lecidea</i>			
subg. <i>Lecidea</i>	± red	red-(brown)	viol./-
subg. <i>Rehmiopsis</i>	± blue	brown	viol./-
Micareaceae			
<i>Micarea</i>	red-brown	red-brown	-
<i>Psilolechia</i>	orange-red	orange-red	-
Porpidiaceae			
<i>Immersaria</i>	orange-red	orange-red	viol./-
<i>Paraporpidia</i>	orange-red/-	orange-red/brown	viol./-
<i>Poeltiaria</i>	-/blue	blue-brown	blue/-
<i>Poeltidea</i>	blue	blue	-
<i>Porpidia</i>	blue	orange/blue-brown	viol./-
Rimulariaceae			
<i>Rimularia</i>	red	red	viol./-
Schaereriaceae			
<i>Schaereria</i>	-	± blue	-
Tremoleciaceae			
<i>Tremolecia</i>	red	red	-

The reaction of the outer ascus wall may be either identical to or different from the hymenial reaction. The characteristic reaction is that in Iconc., which causes bluish or reddish colours in the different taxa. An Iconc. + orange-red to red-brown outer ascus wall is found in *Austrolecia*, *Immersaria*, partly in *Paraporpidia*, in *Rimularia*, *Tremolecia*, within *Lecidea* subg. *Lecidea* and in several genera of the Lecanoraceae. Within *Porpidia*, this reaction differs from species to species. *P. contraponenda*, *P. crustulata*, *P. macrocarpa*, and *P. soledizodes* have an Iconc. + orange outer ascus wall (not too old collections !), while, e.g., in *P. albocaerulescens*, *P. speirea* and *P. umbonifera*, it remains Iconc. + blue-brown. These observations agree with the data given in HERTEL & KNOPH (1984). Within the genera of Lecanoraceae, the amyloid reaction of the outer ascus wall is relatively homogeneous. The rather thick ascus wall of *Lecidella* shows an intensive Iconc. + red-brown reaction, while the thin wall in *Carbonea* reacts negatively or ± blue-brown. The Iconc. reactions of the hymenial gel and the outer ascus wall layer of the genera examined in this study are given in table 3. Melzer's reagent has not been used, as it suppresses all the red reactions which are observed with Lugol's solution (BARAL 1987).

The thickness of the outer ascus wall is, except in *Lecidella* and *Carbonea*, obviously not important in separating genera or species. A distinct outer amyloid wall layer of the asci was not observed in the families Schaereriaceae and Agyriaceae. Between the outer amyloid wall layer and the amyloid structures of the tholus, a more or less distinct non-amyloid wall layer can be observed. Its thickness varies between c. 0.1 - 1.0 µm.

The lecanoralean families usually have a well developed tholus. Maximum and minimum size of the tholus (TRIEBEL & RAMBOLD 1988: 286, fig. 2) have been measured for most species, but seem not to be an important character. The shape of the basal delimitation between tholus and ascus lumen (ascoplast) is very characteristic in several genera. Within the Catillariaceae (*Austrolecia*, *Catillaria*), the Agyriaceae (for asci of *Trapelia* see HERTEL 1970b and RAMBOLD & TRIEBEL in press and fig. 2h), the basal delimitation of the tholus is more or less plane to concave. In the Lecideaceae and the Porpidiaceae, it typically shows a crateriform shape (fig. 2e,f). An ocular chamber could be observed in the genera *Carbonea*, *Lecanora* and *Protoparmelia* (Lecanoraceae), but it is not always developed and vanishes during the maturation of the spores. In genera with conically shaped "masse axiale" (e.g. *Biatora*, *Lecidella*, *Tephromela*, *Tylothallia*), an ocular chamber usually is not detected. The various types of the amyloid structures found in lecideoid species, which characterize families, according to HAFELLNER (1984), are discussed further above. Their infraspecific and infrageneric variability is discussed in HERTEL & RAMBOLD (1985, 1988a) and in HERTEL (1987a).

Spores:

One of the main characteristics of lecideoid lichen genera are the unpig-

mented, non-septate spores. However in some genera these features are not strongly fixed.

Greenish to brownish pigmented spore walls in mature spores occur in species of *Fuscidea*, *Orphniospora* (Fuscideaceae), *Rimularia* (Rimulariaceae) and *Poeltidea* (Porpidiaceae). The degree of pigmentation differs within and between the genera. While in *Fuscidea* and *Rimularia* the pigmentation of the spore walls starts late during spore maturation, it begins quite early in *Orphniospora moriopsis* and becomes relatively dark. Also in *Poeltidea* the spores become pigmented during maturation. The chemical nature of the pigments in the spore walls in lichens is not known.

Septate spores can be observed within the lecideoid lichens in the following genera: *Fuscidea* (e.g. *F. lightfootii* (J.E. Smith) Coppins & P. James), *Biatora*, *Tylothallia*, rarely in *Carbonea* and, according to HERTEL (1987a: 226) in *Lecidella* also. The occurrence of spore septation in *Fuscidea* is not surprising, in so far that the Fuscideaceae are related to the Teloschistaceae, comprising genera with septate or polar-diblastic spores (e.g. *Caloplaca*, *Xanthoria*). The genera *Biatora*, *Tylothallia* and *Lecidella* (Lecanoraceae) have an ascus type similar to that of some genera of the Bacidiaceae sensu Hafellner, a family which comprises genera with non- to pluri-septate spores.

The development of a halonate surface of the spore walls in lecideoid lichens is so far known in the Miltideaceae (with the only genus *Miltidea*), in several genera in the Porpidiaceae, in the genus *Hafellnera* Houmeau & Roux (probably Schaereriaceae), and occasionally also can be observed in *Rimularia* and *Trapelia*. The halo is a special type of perispore structure. POELT (1974: 96) regards it as a generic character; however, it develops only in some stages of the spore maturation and is sometimes absent altogether. Possibly its development correlates with ecological factors. Within the Australian Porpidiaceae, halonate spores were always present in *Porpidia*, which comprises only species growing in either alpine locations or in humid habitats at lower altitudes. The species of *Paraporpidia*, which are adapted to subhumid to arid habitats, show no halonate perispore structures like the Psoraceae. In *Poeltiaria* both spore types were found: *P. turgescens* and *P. corralensis* with halonate spores and *P. coromandelica* usually with non-halonate spores. A different perispore type is the granulate type, which occurs in some species of *Myco-bilimbia*.

Within the lecideoid lichens, the thickness of the spore wall is of diagnostic value only in a few cases. *Lecidea tessellata* Flk. (subg. *Cladopycnidium*), which does not occur in Australia, has much thicker spore walls (up to c. 1.3 μm) than the members of the other two subgenera of *Lecidea* (with c. 0.3 - 0.5 μm). *Orphniospora moriopsis* (Massal.) D. Hawksw., with pigmented spores (see above), and the Northern Hemisphere species *O. mosigii* (Koerb.) Hertel & Rambold, have spores with walls up to 2 μm thick. The members of all other genera treated in this study have spores with relatively thin walls.

The spore size and spore form is an important diagnostic feature in lecideoid lichens. Most common are ellipsoid, ovoid and oblong spore shapes. In some species of *Fuscidea* (e.g. *F. curvula*) or in the Australian *Biatora scorigena*, the spores have a more or less curved form, in *Schae-*

reria cinereorufa, *Sch. xerophila* and *Hafellnera parasemella* (Nyl.) Houmeau & Roux they are globose. Like the spore form, the spore size is also very variable within most genera and represents a suitable diagnostic feature at the species level. Its correlation with the height of the hymenium for the Australian species of the Lecideaceae, lecideoid Micareaceae and Porpidiaceae is shown in fig. 3.

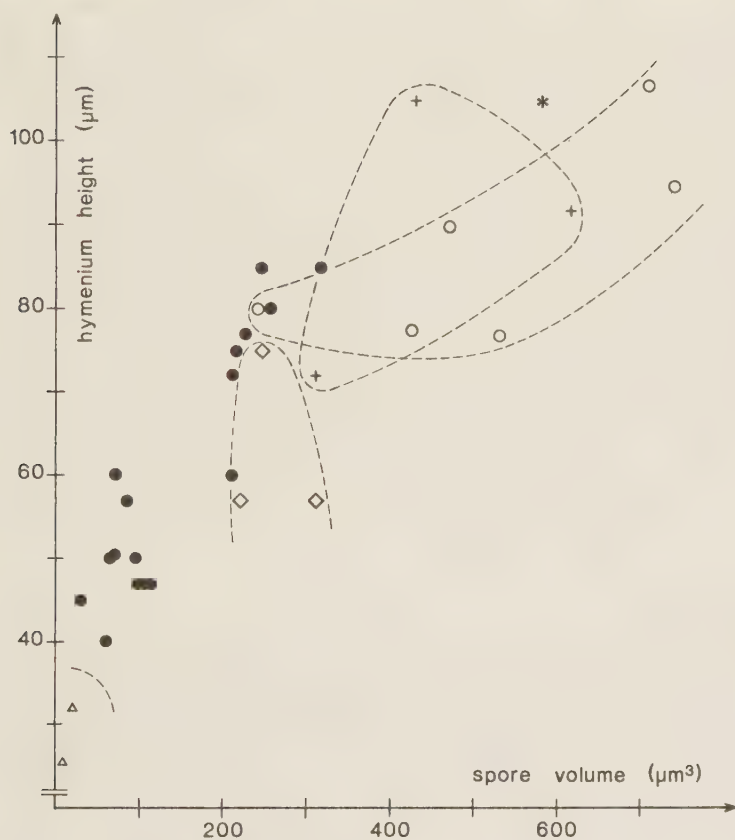


Fig. 3. Correlation of spore volume and height of the hymenium in Australian species of the Lecideaceae: *Lecidea* [●], Micareaceae: *Micarea*, *Psilolechia* [△], and Porpidiaceae: *Immersaria* [*], *Paraporphidia* [◇], *Poeltiaria* [+], *Porpidia* [O] (*Poeltidea* with extremely large spores is omitted).

3.3.6. Pycnidia anatomy

Conidia and conidiogenous cells have not yet been studied sufficiently in lecideoid lichens. In this monograph, these characters could not be examined for every species, as pycnidia were not always developed.

The ostiole and the cells of the pycnidial wall may or may not be pigmented. The form of the pycnidia is globular, bottle-shaped (in most species) or cerebriform (e.g. in species of *Lecidea* subg. *Cladopycnidium*). In general however, form, size, degree of immersion and pigmentation of the pycnidia do not seem to be diagnostically valuable characters in lecideoid lichens. The conidiogenous apparatus (= conidiogenous cells) is taxonomically highly relevant. VOBIS (1980) distinguished five main types in lichens. HERTEL & RAMBOLD (1985) used this character, along with other criteria, for separating *Lecanora* and *Tephromela*.

The size and form of conidia, which, according to their assumed primary function, should probably be called "spermatia", seem to be of taxonomical value at the generic or at the subgeneric level in some cases (fig. 14, 23). Within the Lecanoraceae (incl. Biatraceae and Tephromelataceae) *Tephromela*, e.g., is characterized by cylindrical conidia, *Tylothallia* by ellipsoid conidia, while *Biatora*, *Carbonea*, *Lecidella*, *Lecanora*, *Miriacidica*, *Protoparmelia* (partly), and *Pyrrhospora* show filiform conidia. The conidia of *Clauzadeana* are not known. The differences within the Porpidiaceae are also striking, where, e.g., species of *Porpidia* have cylindrical conidia (6 - 14 µm long), while in *Poeltiaria* they are either cylindrical or filiform. In *Paraporpidia* they are filiform and, with a breadth of c. 0.5 - 1.0 µm, they are relatively thin (fig. 23, p. 238). The breadth of the conidia of lecideoid lichens varies between c. 0.5 µm and c. 1.5 µm and can often only be estimated.

3.4. Chemistry

Secondary metabolites produced by lichens generally have been accepted to be of great utility in lichen taxonomy (e.g. HAWKSWORTH 1976, BRODO 1978). Studies of the chemism of lecideoid lichens demonstrated, that lichen substances are very important diagnostically in this group also (e.g., LEUCKERT & HERTEL 1967, 1969, CULBERSON 1969, HERTEL & LEUCKERT 1969, CULBERSON 1970, CULBERSON & al. 1977, HERTEL 1984, HERTEL & KNOPH 1984, HERTEL & RAMBOLD 1985, 1987).

Many lecideoid representatives of the Lecanoraceae contain atranorin or usnic acid or xanthonones and (in one genus) anthraquinones as specific cortical substances. In other lecideoid families these substances are not so common. Depsides and depsidones, occur especially in the Lecideaceae and Porpidiaceae and are very useful chemical characteristics of taxonomical value (HERTEL 1984). They are located in the medulla as well as in the cortical layer of the thallus and/or in the exciple.

The main compounds found in Australian saxicolous lecideoid lichens are reviewed here.

a) Higher aliphatic acids and esters (fatty acids)

Only three aliphatic acids (bourgeanic acid, rangiformic acid and roccellic acid) could be identified in Australian lecideoid species, mainly in species of the Lecanoraceae. They appear to be accessory compounds, which occur more or less sporadically along with other substances.

b) Orcinol para-depsides

Particularly in *Lecidea* and in several genera of the Porpidiaceae the para-depsides of the orcinol-type play an important role on species and sub-specific level. The most common substance in this group of compounds is confluent acid, which is often accompanied by 2'-O-methylperlatolic acid and 2'-O-methylmicrophyllinic acid. In some species of the Lecanoraceae para-depsides were observed along with atranorin: glomelliferic and perlatolic acids ($\pm$ traces of anziaic acid) in *Tephromela arafurensis*, confluent acid in *Lecanora oreinoides*, 2'-O-methylperlatolic acid in *Biatora solediosa* and in *Carbonea montevidensis*. Miriquidic acid in *Miriquidica deusta* and *M. leucophaea* is usually not accompanied by atranorin. Among the Australian saxicolous lecideoid species, lecanoric acid occurs only in traces in species containing gyrophoric acid as the major substance. Gyrophoric acid has been observed in *Lecidea* subg. *Lecidea* and in the Rimulariaceae, Schaereriaceae and Agyriaceae s.l. Within the Porpidiaceae it is mainly found in the Northern Hemisphere genus *Amygdalaria* (BRODO & HERTEL 1987: 498), in the North African species "*Amygdalaria*" *tellensis* Esnault & Roux (ESNAULT & ROUX 1987: 218), which probably belongs to *Immersaria*.

c) Orcinol depsidones

Orcinol depsidones occur in species of *Lecidella*, *Miriquidica*, *Protoparmelia*, *Tephromela*, *Tylothallia* (all Lecanoraceae). Alecutoronic acid and α -collatolic acid are found along with atranorin (and bourgeanic acid?) in *Tephromela atra*, occurring together or replacing each other. *Tylothallia pahiensis* contains gangaleoidin and lecideoidin. Both substances also either replace each other or are found together along with atranorin. Lobaric acid is known from *Miriquidica deusta* and *Protoparmelia badia*, occurring alternately to or together with the depside miriquidic acid. Diploicin was found in *Lecidella buelliastrum*, vicanicin in *Lecidella sublapicida*.

d) β -orcinol para-depsides

Atranorin was found in most species of the Lecanoraceae. Baeomycesic acid and the accessory substances squamatic and barbatic acids were observed in *Protoparmelia plicatula* (also Lecanoraceae).

e) Benzyl esters

Alecutorialic acid is the only benzyl ester found. It was observed in *Tephromela armeniaca* (Lecanoraceae).

f) β -orcinol depsidones

Depsidones of the β -orcinol-type occur in several lecideoid genera of various families. Norstictic acid, stictic acid and related acids are to

be found in *Austrolecia* (Catillariaceae), *Miriquidica*, *Protoparmelia*, *Pyrrhospora*, and *Tephromela* (Lecanoraceae), *Lecidea* (Lecideaceae), *Porpidia* (Porpidiaceae), and *Rimularia* (Rimulariaceae). Protocetraric acid is known from *Tephromela*, caloploicin from *Lecidella*.

g) Dibenzofurans

A lichen substance, which is hold for porphyrilic acid, was observed in few species of the Lecideaceae and Porpidiaceae.

h) Usnic acids and related compounds

As indicated above, usnic acid plays an important role as a cortical substance in the Lecanoraceae. The only member of Porpidiaceae known as yet, which also contains usnic acid, is *Poeltiaria coromandelica*. Among the other lichen families comprising lecideoid species, only the genus *Pilophorus*, belonging to the Stereocaulaceae (ERIKSSON & HAWKSWORTH 1987a, b), contains isousnic acid (TIMDAL 1988: 95, tab. 1, HERTEL & RAMBOLD 1988a: 298).

i) Xanthones

Xanthones are known from the lecideoid genera *Lecidella* and *Pyrrhospora* (Lecanoraceae). The distribution of xanthones in the saxicolous species of *Lecidella* will be shown and discussed in detail by KNOPH (in prep.).

j) Antraquinones

The psoroid genus *Psora* and the closely related lecideoid genus *Protoblastenia* (both genera of the Psoraceae and not treated in this study) contain antraquinones in the apothecia. Among the Lecanoraceae, antraquinones have been found in the genera *Pyrrhospora* (HAFELLNER 1988), *Adelolecia* (e.g. *A. pilati*) and in one Subantarctic species of *Carbonea* (*C. phaeostoma*) (HERTEL 1984: 472), the latter two contain 2-Cl-emodin.

k) Triterpenoids

Within lecideoid lichens, zeorin was only found in species of the Lecanoraceae. Among the genera, discussed in this study, it occurs in *Lecidella* and *Lecanora*.

l) Pulvinic acid derivates

Psilolechia lucida is the only lecideoid species occurring in Australia, which contains rhizocarpic acid. This lichen substance is also found in *Psora icterica* (Mont.) Müll.Arg. (SCHNEIDER 1980). Pulvinic acid derivates are not known from any other lecideoid species.

Table 4. The distribution of lichen metabolites in lecideoid species of the Agryriaceae (incl. Trapeliaceae and Saccormorphaceae), Catillariaceae, Fuscideaceae, Lecanoraceae (incl. Bacidiaceae p.p., Biatioraceae, Tephromelataceae), Lecideaceae, Micareaceae, Porpidiaceae, Rimulariaceae, Schaereriaceae, Tremoleciaceae.

Aggr. Cat. Fusc. Lecan. Lecid. Mic. Porp. Rim. Schaer. Trem.

Aliphatic acids	-	-	-	+	-	-	(+)	-	-	-
Orc. p-depsides	+	-	+	+	+	-	+	+	+	-
Orc. m-depsides	-	-	-	-	-	-	-	-	-	-
Orc. depsidones	-	-	-	+	-	-	-	-	-	-
β -orc. p-depsides	-	-	-	+	(+)	-	-	-	-	-
β -orc. m-depsides	-	-	-	-	-	-	-	-	-	-
Benzyl esters	-	-	-	+	-	-	-	-	-	-
β -orc. depsidones	-	+	+	+	+	-	+	+	-	+
Dibenzofurans	-	-	-	-	+	-	+	-	-	-
Usnic acids	-	-	-	+	-	-	(+)	-	-	-
Xanthones	-	-	-	+	-	-	-	-	-	-
Anthraquinones	-	-	-	+	-	-	-	-	-	-
Triterpenoids	-	-	-	+	-	-	-	-	-	-
Pulvinic acid deriv.	-	-	-	-	-	+	-	-	-	-
No substances	+	-	- (?)	+	+	+	+	-	+	+

3.4.1. Chemical variation

Both main patterns of chemical variation, which were pointed out for species of the Parmeliaceae by CULBERSON (1970), ELIX (1982: 412), ELIX & al. (1984: 215, 1986: 173) and EGAN (1986), are also observed in lecideoid lichens: a) chemosyndromic variation by replacement type compounds and b) the occurrence of accessory compounds.

a) Chemosyndromic variation and replacement compounds:

Chemosyndromic variation is the most common pattern of chemical variation in lecideoid lichens and occurs in most families. The main substances of the confluent acid chemosyndrome are confluent acid, 2'-O-methylperlatolic acid and 2'-O-methylmicrophyllinic acid. Some species of the Porpidiaceae or Lecideaceae are represented by only one chemotype, invariably containing for example confluent acid (e.g. *Lecidea terrena* or *Porpidia speirea*) or 2'-O-methylperlatolic acid (e.g. *Carbonea montevidensis*) as the major substance, accompanied by one or both of the other two acids (in minor concentrations). Other species, like *Paraporpidia leptocarpa*, *P. glauca* and *Immersaria athroocarpa*, are represented by two chemical strains with either confluent acid or 2'-O-methylperlatolic acid as the major constituents. The stictic acid chemosyndrome has been observed e.g. in *Lecidea lapicida*, *L. lygomma* agg., and *Porpidia albocaerulescens*. All three taxa are represented by two chemical

strains containing either stictic acid or norstictic acid as the major substance and rarely both substances in equal amounts. Because of various morphological and ecological differences, these strains have been treated in different ways. In *L. lapicida* they are regarded as "chemotypes" of one species without different taxonomical status. In the *L. lygomma*-complex, the two strains are regarded as two different species, because of small but constant morphological differences. (The stictic acid containing specimens mostly show a less developed thallus and are separated as *L. crassilabra*). In *Porpidia albocaerulescens*, the two chemotypes are treated as varieties, showing a different distribution.

Chemosyndromic variation is also known within the Lecanoraceae; e.g. in *Miriquidica deusta* with miriquidic or lobaric acids as the major substance, in *Tylothallia pahiensis* with gangaleoidin or lecideoidin as the major substance; and in *Tephromela atra* with alecronic acid or α -collatolic acid as the major substance. Rather complex patterns of variation, observable in xanthonic-containing species of *Lecanora* and *Lecidella*, will be demonstrated and discussed for *Lecidella* in detail by KNOPH (in prep.).

b) Accessory compounds:

According to ELIX (1982) accessory compounds occur sporadically in one and the same species, usually in addition to the constant constituents and have no correlation with any morphological or distributional variation. This phenomenon is also observed in several genera of lecideoid lichens. The most common acids involved are gyrophoric acid, stictic acid and norstictic acid, sporadically occurring in several species of the Lecideaceae and Porpidiaceae (e.g. frequently in *Lecidea fuscoatrula* or rarely in *Paraporpidia leptocarpa*). The occurrence of these acids, however, can also be caused by overlooked thallus fragments of parasitizing lichens. In *Tephromela atra* and *Tephromela armeniaca* the fatty acids bourgeanic acid and roccellic acid occurred sporadically.

Consistently lichen acid deficient species among the Australian lecideoid genera belong to *Carbonea* (*C. vorticosa*), *Lecidea* (*L. sarcogynoides*), *Micarea* (*M. erratica*), *Poeltidea* (*P. perusta*), and *Porpidia* (*P. umbonifera*).

Lichen acid deficient strains or "0-strains" (LEUCKERT & POELT 1978) of species, which typically contain lichen substances have been observed in *Lecidea* (*L. ochroleuca*, *L. terrena*) and *Poeltiaria* (*P. corralensis*). In the case of the closely related *L. ochroleuca* and *L. terrena*, which are morphologically and anatomically rather similar, lichen substance deficient specimens generally are difficult to assign to either of the two taxa.

3.4.2. The diagnostically important lichen substances identified by TLC

The substances are characterized according to CULBERSON & AMMANN (1979). Literature referring to the chemical structure and the synthesis or to its occurrence in lecideoid lichens is cited under each substance. For further relevant literature see CULBERSON (1969, 1970), CULBERSON & al. (1977), ELIX & al. (1984) and HUNECK (1984).

[The R_F -classes refer to the three solving systems A, B, C;
DL: colour of spot on the TLC - plate under daylight, before charring;
 H_2SO_4 : colour of spot after charring, sprayed with sulphuric acid;
AS: colour of spot after charring, sprayed with anisaldehyd-sulphuric acid;
UV₂₅₄: spot is quenching U.V. fluorescence of 254 nm or not;
UV₃₅₀: colour of the spot under wavelength 350 nm before charring;
UV₃₅₀*: colour of spot in U.V. fluorescence under wavelength 350 nm after spraying with H_2SO_4 and after charring].

Higher aliphatic acids and esters (fatty acids)

Bourgeanic acid: R_F -classes: 5-6 / 5 / 5 (-6); DL: not visible; H_2SO_4 -; AS -; UV₂₅₄ -; UV₃₅₀ -; UV₃₅₀* -.

Observed in *Porpidia soredizodes*, *Tephromela atra*.

Literature: BODO (1975), HERTEL & RAMBOLD (1988a).

Rangiformic acid: R -classes: 3 / 5 / 5; DL: not visible; H_2SO_4 -; AS -; UV₂₅₄ -; UV₃₅₀ -; UV₃₅₀* -.

Observed in *Lecanora polytropha*.

Literature: HUNECK (1966b, 1982).

Roccellic acid: R_F -classes: 4 / 5 / 5; DL: not visible; H_2SO_4 -; AS -; UV₂₅₄ -; UV₃₅₀ -; UV₃₅₀* -.

Observed in *Lecanora demersa*, *Tephromela armeniaca*.

Literature: BRODO (1984).

para-Depsides (Orcinol-type)

Anziaic acid: R_F -classes: 3 - 4 / 5 / 5; DL: not visible; H_2SO_4 + ochraceous; AS + red; UV₂₅₄ +; UV₃₅₀ -; UV₃₅₀* + green.

Observed in *Lecidea cerviniicola* (minor subst., in traces), *Tephromela arafurensis* (in traces).

Literature: CULBERSON & HERTEL (1972), ELIX (1974).

Confluentic acid: R_F -classes: 5 / 5 / 6; DL: not visible; H_2SO_4 + pale yellowish-brownish; AS + red; UV₂₅₄ +; UV₃₅₀ +; UV₃₅₀* + olive-green or olive-brown.

Notes: In several species together with 2'-O-methylperlatolic acid and 2'-O-methylmicrophyllinic acid.

Observed in *Immersaria athroocarpa* (major subst. or not), *Lecanora oreinoides* (major subst.), *Lecidea capensis* (rarely as minor subst.), *L. fuscoatrula* (major subst. or not), *L. promiscens* (major subst. or not), *L. sarcogynoides* (rarely in traces), *L. terrena* (major subst. or not), *L. tragorum* (major subst. or not), *Paraporphidia glauca* (major subst. or not), *P. leptocarpa* (major subst. or not), *Poeltiaria coromandelica* (?), *P. turgescens* (major subst.), *Porpidia speirea* (major subst.).

Literature: ELIX & FERGUSON (1978), HANKO (1983), HERTEL (1984); GOWAN (1989a, b).

4-0-Demethylplanaic acid: R_F -classes: 3-4 / 4 / 4; DL: not visible; H_2SO_4 + creamy brownish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + oliveaceous.

Observed in *Lecidea plana* (minor subst.).

Literature: ELIX (1974), CULBERSON & HERTEL (1979), HERTEL (1984), SCHWAB (1986).

Divaricatic acid: R_F -classes: 5 / 6 / 5-6; DL: not visible; H_2SO_4 + creamy-brownish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + bluish to greenish-blue.

Observed in *Fuscidea* sp. [not treated here].

Literature: LEUCKERT & al. (1975).

Glomelliferic acid: R_F -classes: 4-5 / 5 / 5; DL: not visible; H_2SO_4 + ochraceous; AS + red; UV_{254} +; UV_{350} + pale whitish; UV_{350}^* + olive-green.

Observed in *Tephromela arafurensis*.

Literature: HUNECK & al. (1973).

Gyrophoric acid: R_F -classes: 3 / 5 / 3 (- 4); DL: not visible; H_2SO_4 + yellowish to brownish; AS + rose, red, brownish; UV_{254} +; UV_{350} -; UV_{350}^{**} green.

Observed in *Carbonea montevidensis* (rarely, additionally), *Lecidea atromorio* (major subst.), *L. ochroleuca* (major subst. or not), *Paraporphidia leptocarpa* (rarely, additionally in traces), *Rimularia australis* (major subst.), *R. exigua* (major subst.), *R. insularis* (major subst.), *Schaereria fuscocinerea* (major subst.), *Trapelia* sp. [not treated here].

Literature: HERTEL & LEUCKERT (1969), JAYALAKSHMI & al. (1969), BRYAN & al. (1976), HANKO (1983), HERTEL (1984).

Lecanoric acid: R_F -classes: 3 / 5 / 3; DL: not visible; H_2SO_4 + yellowish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + olive-green.

Notes: As minor substance observed in species with gyrophoric acid, probably representing a hydrolysis product of gyrophoric acid (LEUCKERT 1985).

Literature: HERTEL & LEUCKERT (1969), BRYAN & al. (1976).

2'-O-Methylaniziaic acid: R_F -classes: 4 / 5 / 5; DL: not visible; H_2SO_4 + creamy brownish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + olive-green. Observed in *Lecidea diducens* (major subst.).

Literature: CULBERSON & HERTEL (1972), ELIX (1974).

Methyl 2'-O-methylmicrophyllinate [= unknown "P-2" in HERTEL & KNOPH 1984]: R_F -classes: 6 / 4 (-5) / 5-6; DL: not visible; H_2SO_4 + rose; AS + violet; UV_{254} +; UV_{350} -; UV_{350}^* + bluish.

Observed in *Porpidia contraponenda*.

Literature: GOWAN & BRODO (1988), GOWAN (1989a, b).

2'-O-Methylmicrophyllinic acid [? = "unknown 3-4, 3, 5, 3" in WHITE & JAMES 1985]: R_F -classes: 4-5 / 3 (-4) / 5; DL: not visible; H_2SO_4 + pale rose; AS + rose to reddish; UV_{254} +; UV_{350} -; UV_{350}^* + blue.

Observed in *Immersaria athroocarpa* (minor or in traces), *Lecidea fuscoatrula* (major subst. or not), *L. promiscens* (in traces), *L. terrena* (minor subst. or in traces), *L. tragorum* (minor subst.), *Paraporpidia aboriginum* (major subst.), *P. glauca* (minor subst. or in traces), *P. leptocarpa* (minor subst. or in traces), *Poeltiaria turgescens* (in traces), *Porpidia speirea* (minor subst. or in traces).

Literature: CHESTER & ELIX (1981), ("unknown "P-3") HERTEL & KNOPH (1984), GOWAN & BRODO (1988), GOWAN (1989a, b).

2'-O-Methylperlatolic acid: R_F -classes: 5-6 / 5-6 / 6; DL: not visible; H_2SO_4 + creamy brownish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + oliveaceous.

Observed in *Biatora solediosa* (major subst.), *Carbonea montevidensis* (major subst.), *Immersaria athroocarpa* (major subst. or not), *Lecidea atrobrunnea* (major subst.), *L. capensis* (major subst.), *L. promiscens* (minor subst.), *L. terrena* (minor subst. or in traces), *L. tragorum* (rarely additionally in traces), *Paraporpidia glauca* (major subst. or not), *P. leptocarpa* (major subst. or not), *Poeltiaria turgescens* (minor subst.), *Porpidia speirea* (minor subst.).

Literature: ELIX (1974), HANKO (1983), HERTEL (1984, 1985).

Miriquidic acid: R_F -classes: -5 / 5 / 5-; DL: not visible; H_2SO_4 + first brownish, later green to bluish green; AS + violet; UV_{254} +; UV_{350} -; UV_{350}^* + yellowish to brown.

Observed in *Miriquidica deusta*, *M. leucophaea*.

Literature: HUNECK & al. (1971), ELIX & JAYANTHI (1986), HERTEL & RAMBOLD (1987).

Perlatolic acid: R_F -classes: 5 / 6 / -6; DL: not visible; H_2SO_4 + ochraceous; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + olive-green.

Observed in *Lecidea cerviniicola* (major subst.), *Tephromela arafurensis* (minor subst.).

Literature: CULBERSON & HERTEL (1972), ELIX (1974).

Planaic acid: R_F -classes: 5 / 5 / 6; DL: not visible; H_2SO_4 + creamy brownish; AS + red; UV_{254} +; UV_{350} -; UV_{350}^* + olive-green. Observed in *Lecidea plana* (major subst.).

Literature: ELIX (1974), CULBERSON & HERTEL (1979), HERTEL (1984), SCHWAB (1986).

Depsidones (Orcinol-type)

Alectoronic acid: R_F -classes: 3 / 4 / (2 -) 3; DL: not visible; H_2SO_4 -; AS + pale brownish; UV_{254} +; UV_{350} + whitish; UV_{350}^* + greyish. Observed in *Tephromela atra* (major subst. or not).

Literature: ELIX & al. (1974), ROGERS (1982a), HANKO (1983).

α -Collatolic acid: R_F -classes: 4 / 5 / 5; DL: not visible; H_2SO_4 + pale yellowish to brownish; AS -; UV_{254} +; UV_{350} + whitish; UV_{350}^* + greyish.

Observed in *Tephromela atra* (major subst. or not).

Literature: HÜNECK & al. (1973), ROGERS (1982a), HERTEL (1984), HERTEL & RAMBOLD (1985).

Diploicin: R_F -classes: 6 / 6 / 6; DL: not visible; AS -; UV_{254} +; UV_{350} + yellowish-whitish.

Observed in *Lecidella buelliastrum*.

Literature: DJURA & al. (1976), LEUCKERT & al. (in press); KNOPH (in prep.).

Gangaleoidin: R_F -classes: -6 / 5 / 5-6; DL: not visible; H_2SO_4 + yellow; AS -; UV_{254} +; UV_{350} -; UV_{350}^* + yellow.

Observed in *Tylothallia pahiensis* (major subst. or not).

Literature: SARGENT & al. (1975), CULLEN & SARGENT (1981), BRODO (1984).

Lecideoidin: R_F -classes: 5 / 5 / 5; DL: not visible; H_2SO_4 -; AS + pale reddish; UV_{254} +; UV_{350} + whitish; UV_{350}^* + blue.

Observed in *Tylothallia pahiensis* (major subst. or not).

Literature: CHESTER & al. (1979), McEWEN & SARGENT (1981).

Lobaric acid: R_F -classes: 3- / 5 / 5; DL: not visible; H_2SO_4 + pale yellowish-brownish; AS -; UV_{254} +; UV_{350} -; UV_{350}^* + blue.

Observed in *Miriquidica deusta*, *Protoparmelia badia*.

Literature: HERTEL & RAMBOLD (1987).

Vicanicin: R_F -classes: 6 / 6 / 6; DL: not visible; AS -; UV_{254} +; UV_{350} + pale whitish.

Observed in *Lecidella sublapicida*.

Literature: KNOPH (in prep.).

Vicanicin methyl ether: R_F -classes: 7 / 8 / 7-8 ; DL: not visible; AS-; UV₂₅₄ +; UV₃₅₀ + pale whitish.
Observed in *Lecidella sublapicida*.
Literature: KNOPH (in prep.).

para-Deposides (β-Orcinol-type)

Atranorin : R_F -classes: 7 / 7 / 7; DL: + pale yellow; H₂SO₄ + yellowish to brown; AS -; UV₂₅₄ +; UV₃₅₀ ± violet; UV₃₅₀* + brownish.

Observed in *Biatora solediosa*, *Carbonea montevidensis*, *Lecanora demersa*, *L. impressa*, *L. marginata*, *L. oreinoides*, *Lecidella buelliastrum*, *Lecidella chodati*, *L. enteroleucella*, *L. stigmathea*, *Tephromela arafurensis*, *T. atra*, *Tylothallia pahiensis* (in all species, except of *L. stigmathea*, an obligate cortical substance).

Literature: LEUCKERT & HERTEL (1967, 1969), BRODO (1984), HERTEL (1984), LEUCKERT & al. (in press), KNOPH (in prep.).

Baeomycesic acid: R_F -classes: -4 / 5 / 5; DL: + yellow; H₂SO₄ + orange; AS + reddish; UV₂₅₄ +; UV₃₅₀ + orange-red; UV₃₅₀* + orange.

Observed in *Protoparmelia plicatula* (major subst.).

Literature: ELIX & NORFOLK (1975), DIBBEN (1980).

Barbatic acid: R_F -classes: 4 (-5) / 6 / 5-6; DL: + yellow; H₂SO₄ + ochraceous; AS + reddish, UV₂₅₄ +; UV₃₅₀ + whitish (?); UV₃₅₀* + brownish.

Observed in *Protoparmelia plicatula* (minor subst.).

Literature: ELIX & NORFOLK (1975).

Squamatic acid: R_F -classes: 2 / 3 / 3-4; DL: + yellow; H₂SO₄ + yellowish; AS -; UV₂₅₄ +; UV₃₅₀ + blue; UV₃₅₀* + pale orange.

Observed in *Protoparmelia plicatula* (minor subst.).

Literature: ELIX & NORFOLK (1975).

Benzyl esters

Alectorialic acid: R_F -classes: -4 / 5 / 4-5; DL: not visible; H₂SO₄ + brown; AS + yellowish to orange; UV₂₅₄ +; UV₃₅₀ + greyish; UV₃₅₀* + dark red-brown.

Observed in *Tephromela armeniaca* (major subst.).

Literature: PERSSON & SANTESSON (1970), HERTEL & RAMBOLD (1985).

Deposidones (β-Orcinol-type)

Caloploicin: R_F -classes: 6 / 6 / 6 ; DL: not visible; H₂SO₄ (?); AS -; UV₂₅₄ +; UV₃₅₀ ± reddish.

Observed in *Lecidella buelliastrum*.

Literature: KNOPH (in prep.)

Connorstictic acid: R_F -classes: 2 / 2 / 1-2; DL: not visible; H_2SO_4 + orange; AS + orange; UV_{254} +; UV_{350} -; UV_{350}^* + blackish.

Observed in species with norstictic acid as major substance (e.g. *Protoparmelia petraeoides*).

Literature: ELIX & LAJIDE (1981).

Constictic acid: R_F -classes: 2 / 1-2 / 1 (-2); DL: not visible; H_2SO_4 + ochraceous; AS + yellowish; UV_{254} +; UV_{350} + greyish; UV_{350}^* + orange to brownish.

Observed in species with stictic acid as major substance.

Literature: YOSIOKA & al. (1970), SCHWAB (1986).

Norstictic acid: R_F -classes: 4 / 4 / 4; DL: not visible; H_2SO_4 + yellow; AS + yellow; UV_{254} +; UV_{350} +- violet; UV_{350}^* + dark brown.

Observed in *Austrolecia antarctica* (major subst.), *Carbonea montevidensis* (rarely, additionally), *Immersaria athrocarpa* (rarely, additionally in traces), *Lecidea atromorio* (occasionally, in traces), *L. fuscoatrula* (additionally, as minor subst.), *L. lapicida* (major subst. or not), *L. lygomma* (major subst. or not), *Miriquidica deusta* (additionally), *Paraporphidia leptocarpa* (rarely, additionally, in traces), *Porpidia albocaerulescens* (major subst. or not), *Protoparmelia petraeoides* (major subst.), *Pyrrhospora sanguinolenta* (major subst.), *Rimularia exigua* (rarely, additionally), *R. psephota* (major subst.).

Literature: LEUCKERT & HERTEL (1969), MARTINEZ & MESTRES (1972), HANKO (1983), HERTEL (1984), SCHWAB (1986).

Protocetraric acid: R_F -classes: 2 / -3 / 1-2; DL: -; H_2SO_4 + bluish-grey; AS + grey; UV_{254} +; UV_{350} -; UV_{350}^* + brownish-black.

Observed in *Tephromela armeniaca*.

Literature: DIBBEN (1980), HERTEL & RAMBOLD (1985).

Stictic acid: R_F -classes: 3 / 2 / 2-3; DL: + yellow; H_2SO_4 + orange-yellow; AS + orange; UV_{254} +; UV_{350} -; UV_{350}^* + blackish-brown.

Observed in *Lecidea crassilabra* (major subst.), *L. fuscoatrula* (rarely, additionally, in traces), *L. lapicida* (major subst. or not), *Porpidia albocaerulescens* (major subst. or not), *P. crustulata* (major subst.), *P. soredizodes* (major subst.).

Literature: HERTEL (1984), SCHWAB (1986).

Dibenzofurans

Porphyrylic acid: R_F classes: 2 / 2 / 1-2; DL: not visible; H_2SO_4 + greyish; AS + pale greyish to reddish; UV_{254} +; UV_{350} -; UV_{350}^* + greyish.

Observed in *Lecidea lygommoides* (major subst.), *Poeltiaria corralensis* (major subst. or not).

Literature: HUNECK (1966a), SCHWAB (1986).

Usnic acids and related compounds

Usnic acid: R_F -classes: 6- / 6 / 6; DL: + yellow; H_2SO_4 + brownish; AS + violet; UV_{254} +; UV_{350} + greyish; UV_{350}^* + blackish.

Observed in *Lecanora marginata*, *L. polytropa*, *Poeltiaria coromandelica*.

Literature: LEUCKERT & HERTEL (1967), ELIX & TRONSON (1973), BEHRENS & al. (1976), HERTEL (1985), HERTEL & RAMBOLD (1985).

Xanthones (data supplied by KNOPH in litt.)

Arthothelin (= 2,4,5-Trichloronorlichexanthone): R_F -classes: 4 / 4 / 4-5; AS -; DL: + yellowish; UV_{254} +; UV_{350} + red-brown.

Observed in *Lecidella enteroleucella*.

Literature: HUNECK & HÖFLE (1978), LEUCKERT & al. (in press), KNOPH (in prep.).

Isoarthothelin (= 2,5,7-Trichloronorlichexanthone): R_F -classes: 5 / 5-6 / 5; AS -; DL: + yellowish; UV_{254} +; UV_{350} + brown.

Observed in *Lecidella chodati*, *L. sublapicida*.

Literature: KNOPH (in prep.).

Lichexanthone: R_F -classes: -7 / -7 / -7; DL: + yellow; H_2SO_4 + orange; AS + yellowish; UV_{254} +; UV_{350} + yellow, ochraceous to orange.

Observed in *Pyrrhospora sanguinolenta*.

Literature: LEUCKERT & HERTEL (1969), HAY & HARRIS (1972), KNOPH (in prep.).

O-Methylasemon (3-O-Methyl-4,5,7-trichloronorlichexanthone):

R_F -classes: 6 / 6 / 6; DL: not visible to pale yellowish; AS -; UV_{254} +; UV_{350} + yellow-brown.

Observed in *Lecidella buelliastrum*.

Literature: KNOPH (in prep.).

3-O-Methyl-2,5,7-trichloronorlichexanthone: R_F -classes: 6 / (5-) 6 / 6;

DL: not visible to pale yellowish; AS -; UV_{254} +; UV_{350} + yellow-brown.

Observed in *Lecidella chodati*, *L. sublapicida*.

Literature: KNOPH (in prep.).

Thiophanic acid (= 2,4,5,7-Tetrachloronorlichexanthone): R_F -classes:

5 / 6 / 5; DL: yellowish; UV_{254} +; UV_{350} + brown to dark brown.

Observed in *Lecanora impressa* (?), *Lecidella buelliastrum*, *L. chodati*.

Literature: LEUCKERT & HERTEL (1969), NEELAKANTAN & THILLAI-CHIDAMBARAM (1973), LEUCKERT & al. (in press), KNOPH (in prep.).

Thuringione (3-O-Methyl-2,4,5-trichloronorlichexanthone): R_F -classes: 5/6/5 (-6); DL: pale yellowish (?) or not visible; UV_{254} +; UV_{350} + brown to orange-brown.

Observed in *Lecidella enteroleucella*.

Literature: HUNECK & SANTESSON (1969), FITZPATRICK & al. (1980), LEUCKERT & al. (in press), KNOPH (in prep.).

Triterpenoids

Zeorin: R_F -classes: 5 / 5 / 5; DL: not visible; H_2SO_4 + violet-brown; AS + violet, later blue; UV_{254} -; UV_{350} - (?); UV_{350}^* + brown.

Observed in *Lecanora impressa*, *L. polytropa* (traces), *Lecidella stigmatea*.

Literature: YOSIOKA & al. (1971), NAKANISHI & al. (1971), BRODO (1984), HERTEL (1984), KNOPH (in prep.).

Pulvinic acid derivatives

Rhizocarpic acid: R_F -classes: 6/5/6; DL: + yellow; H_2SO_4 + vivid yellow; AS + yellowish; UV_{254} +; UV_{350} + red; UV_{350}^* + blackish.

Observed in *Psilolechia lucida* (major subst.).

Substances of unknown structure (data supplied by KNOPH in litt.)

Chodat: R_F -classes: 6/ 6/ 6; AS -; DL: not visible; UV_{254} +; UV_{350} + reddish.

Observed in *Lecanora impressa*, *Lecidella chodati*.

Literature: KNOPH (in prep.).

Demethylchodatin: R_F -classes: 5/ 5/ 5; AS -; DL: not visible; UV_{254} +; UV_{350} + reddish.

Observed in *Lecanora impressa*, *Lecidella chodati*.

Literature: KNOPH (in prep.).

Unknown CM-1: R_F -classes: 7- / 7 / 7-8; DL: not visible; H_2SO_4 + ochraceous; AS -; UV_{254} +; UV_{350} + whitish; UV_{350}^* + olive-green.

Observed in *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold.

No substances

Observed in *Carbonea vorticosa* (obligatorily), *Lecidella stigmatea* agg., *Lecidea ochroleuca*, *L. lygoma*, *L. sarcogynoides* ($\pm$ obligatorily), *L. terrena*, *L. tragorum*, *Micarea erratica* (obligatorily), *Poeltiaria corralensis*, *Poeltidea perusta* (obligatorily), *Porpidia macrocarpa*, *P. umbonifera* (obligatorily), *Tremolecia atrata*.

3.5. World distribution

The knowledge of the distribution of lecideoid lichens is rather incomplete. Nevertheless a preliminary attachment of the Australian representatives to several floristic elements seems possible.

Recent studies of lecideoid lichens in the Southern Hemisphere (HERTEL 1984) have shown, that endemism is much less frequent in this lichen group than initially suggested (e.g. by DODGE 1973, GALLOWAY 1985). This is also the case with the Australian representatives of this lichen group.

Two species, *Biatora solediosa* and *Tephromela arafurensis*, of the eleven hitherto unknown from Extra-Australian regions and preliminarily regarded as endemic elements in this study, are restricted to northern Australia and probably also occur in the Indonesian-Malayan region. The three alpine "endemics", which are not yet known from elsewhere, *Lecidea crassilabra*, *Lecidea lygommoides*, and *Porpidia umbonifera*, probably have a much wider distribution in the world, as do most other Australian lecideoid species occurring in the alpine zone. *Biatora scorigena*, *Protoparmelia plicatula* and *Schaereria xerophila* are restricted to the warm temperate south-eastern and eastern part of the continent and are probably true endemics as is *Paraporpidia aboriginum*, which is restricted to the centre of the continent. *Rimularia australis* occurs in the eastern and western part of Australia, *Rimularia exigua* is known from several localities of southern and south-eastern Australia, and *Paraporpidia glauca*, which is widely distributed over the continent, occurs in semi-arid to arid areas. The occurrence of lecideoid lichens in Tasmania and New Zealand has not been studied sufficiently yet, so that no reliable data exist about endemic species in these parts of Australasia.

Lecanora demersa, *Lecidella sublapicida*, *Pyrrhospora sanguinolenta*, *Poeltiaria coromandelica*, *Poeltiaria turgescens* and *Tylothallia pahiensis* are regarded as Australasian endemics.

Except for *L. demersa*, which may also be an austral element of wider distribution, they occur in non-alpine habitats. During current revisions of *Lecidella* (by J.-G.Knoph) and *Pyrrhospora* (by J.Hafellner), Extra-Australasian specimens of *L. sublapicida* and *P. sanguinolenta* have not yet been found.

Five species of *Lecidea* subg. *Lecidea*, *L. atomorio*, *L. capensis*, *L. fuscoatrula*, *L. terrena* and *L. tragorum*, and one species of *Lecidella* (*L. buelliastrum*), growing mostly under dry and semi-arid to arid conditions, co-occur in Australasia and South Africa and represent the "southern xeric" element, that is the "mediterranean" component of the austral element.

Carbonea montevidensis and *Poeltiaria corralensis* occur in Australasia, South Africa and South America. Within Australia, both species are restricted to the temperate south-eastern part of the continent, the first growing in open habitats on exposed rocks, the latter predominantly in rainforest areas.

The alpine lecideoid species of Australasia are composed of endemic taxa, of the Southern Hemisphere species belonging to the "austral" element, and of taxa with "bipolar" distributions in the sense of DU

RIETZ (1940). Austral elements with an alpine occurrence are *Austrolecia antarctica*, *Lecidea lygomma*, *Poeltidea perusta*, and *Rimularia psephota*. Originally they all were described from the Subantarctic Islands and they also occur in New Zealand. Their occurrence in continental Australia was hitherto unknown.

The bipolar species, growing in similar habitats in the Northern Hemisphere - where they all have been originally described from - constitute the major part of the lecideoid taxa growing at higher elevations in Australia. They comprise about twenty species, which have nearly all been collected in the alpine zone of the Snowy Mountains, of the Victorian Alps and the Brindabella Range: *Carbonea vorticosa*, *Clauzadeana macula*, *Immersaria athrocarpa*, *Lecanora marginata*, *Lecanora polytropha*, *Lecidea atrobrunnea*, *Lecidea cerviniicola*, *Lecidea diducens*, *Lecidea lapicida*, *Lecidea plana*, *Lecidea promiscens*, *Miriquidica deusta*, *Miriquidica leucophaea*, *Porpidia contraponenda*, *Porpidia macrocarpa*, *Porpidia speirea*, *Protoparmelia badia*, *Rimularia insularis*, *Schaereria fuscocinerea*, *Tephromela armeniaca*, and *Tremolecia atrata*.

Species which belong to the so-called "mediterranean" element (here called "xeric element") occur in both hemispheres, growing at lower altitudes under temperate to arid conditions. Lecideoid lichens of this element are e.g. *Lecidea sarcogynoides* and *Protoparmelia petraeoides*. Both are distributed widely in continental Australia. *L. sarcogynoides* was described originally from Europe, while *P. petraeoides*, which prefers cool to warm temperate and subhumid to dry habitats, has hitherto only been known from Australasia and recently was found also in South Africa (HAIDUK pers. comm.) and Europe (Sardinia) (NIMIS & POELT 1987).

Lecanora impressa is a species which occurs in the subtropical and tropical regions of the Southern Hemisphere and probably represents a pantropical element. *Lecanora oreinoides* and *Porpidia albocaerulescens* are distributed in more temperate, extra-tropical regions of both hemispheres.

Paraporpidia leptocarpa is known from Australasia and Eastern Asia and probably belongs to the Eastern Asian element (? = Western Pacific element), which GALLOWAY (1979) regards as equivalent to the "Malayo-Pacific element" of FLEMING (1963). *Lecidella enteroleucella* is distributed in Australasia and Eastern Asia, but has also been found in South Africa.

Ubiquitous species with a wide ecological amplitude, that occur in temperate climate zones of both hemispheres are: *Lecidella stigmatea*, *Micarea erratica*, *Porpidia crustulata* and *Tephromela atra*. The nitrophilous species *Lecidella stigmatea* probably occurs in most extra-tropical regions of the world, growing on siliceous as well as calcareous substratum, often under anthropogenously influenced conditions (WIRTH 1980). *P. crustulata* and *M. erratica* have quite similar ecological requirements and are widely distributed in extra-tropical regions growing on stones or small boulders under (sub-)humid conditions.

Following the nomenclature used by GALLOWAY (1985, 1987, 1988) and partly by JØRGENSEN (1983), the species discussed in this study can be preliminarily assigned to the following biogeographical elements:

Endemic element (taxa confined to Australia only): *Biatora scorigena*, *Paraporphidia aboriginum*, *Paraporphidia glauca*, *Protoparmelia plicatula*, *Schaereria xerophila*.

Preliminarily included are: *Biatora solediosa* (or western pacific or palaeotropical ?), *Lecidea crassilabra* (or australasian ?), *Lecidea lygomoides* (or australasian ?), *Porpidia umbonifera* (or bipolar ?), *Rimularia australis* (or australasian ?), *Rimularia exigua* (or bipolar ?), *Tephromela arafurensis* (or western pacific or palaeotropical ?).

Australasian element (taxa occurring in Australia and New Zealand): *Lecanora demersa*, *Lecidella sublapida*, *Pyrrhospora sanguinolenta*, *Poeltiaria coromandelica*, *Poeltiaria turgescens*, *Tylothallia pahiensis*.

Austral element (taxa occurring in South-East Australia, New Zealand, the Subantarctic Islands and southern South America): *Austrolecia antarctica*, *Lecidea lygomma*, *Poeltiaria corralensis*, *Poeltidea perusta*, *Rimularia psephota*.

Southern xeric element (taxa occurring in the dry areas of South Africa, continental Australia, New Zealand and South America, usually defined by winter rainfall-summer drought conditions): *Carbonea montevidensis*, *Lecidea atromorio*, *Lecidea capensis*, *Lecidea fuscoatrula*, *Lecidea terrena*, *Lecidea tragorum*, *Lecidella buelliastrum*.

Xeric element (taxa occurring in mediterranean or arid regions of both hemispheres): *Lecidea ochroleuca*, *Lecidea sarcogynoides*, *Lecidella chodati*, *Protoparmelia petraeoides*.

Cosmopolitan element (taxa occurring in most known continents): *Lecidella stigmatea*, *Micarea erratica* (?), *Porpidia crustulata*, *Psilolechia lucida* (?), *Tephromela atra*.

Bipolar element (taxa occurring in alpine localities of the Southern Hemisphere and in boreo-alpine habitats of the Northern Hemisphere): *Carbonea vorticosa*, *Clauzadeana macula*, *Immersaria athrocarpa*, *Lecanora marginata*, *Lecanora polytropia*, *Lecidea atrobrunnea*, *Lecidea cerviniicola*, *Lecidea diducens*, *Lecidea lapida*, *Lecidea plana*, *Lecidea promiscens*, *Miriquidica deusta*, *Miriquidica leucophaea*, *Porpidia contrapomenda*, *Porpidia macrocarpa*, *Porpidia speirea*, *Protoparmelia badia*, *Rimularia insularis*, *Schaereria fuscocinerea*, *Tephromela armeniaca*, *Tremolecia atrata*.

Eastern Asian element (taxa occurring on the Asiatic seaboard, Japan, China, Malesia, New Guinea, New Caledonia, the east coast of Australia and New Zealand): *Paraporphidia leptocarpa*.

Pantropical element (taxa occurring in all tropical areas of the world):
Lecanora impressa.

Species with obscure distribution, or species which cannot be assigned to one of the cited biogeographical elements, are: *Lecanora oreinoides*, *Lecidella enteroleucella*, *Porpidia albocaerulescens*, and *Porpidia soledizodes*.

3.6. Enumeration of the saxicolous lecideoid taxa, originally described from Australia

Forty-five saxicolous lecideoid taxa were described originally from Australia. Fourteen taxa are accepted, two with unchanged status.

Table 5. Basionyms (left) and accepted names (right) of the species and varieties of saxicolous lecideoid lichens, described on Australian material [ordered chronologically with regard to the date of description].

<i>Lecidea ochroleuca</i> Pers. in Gaudich (1826)	= <i>Lecidea ochroleuca</i>
<i>Lecidea glauca</i> Th.Tayl. (1847)	= <i>Paraporpidia glauca</i>
<i>Lecidea leptocarpa</i> Nyl. ex Bab. & Mitt. (1859)	= <i>Paraporpidia leptocarpa</i>
<i>Lecidea petraeoides</i> Nyl. ex Bab. & Mitt. (1859)	= <i>Protoparmelia petraeoides</i>
<i>Aspicilia oreinoides</i> Koerb. (1862)	= <i>Lecanora oreinoides</i>
<i>Lecidella turgescens</i> Koerb. (1862)	= <i>Poeltiaria turgescens</i>
<i>Callopsisma sanguinolentum</i> Kremp. (1877)	= <i>Pyrrhospora sanguinolenta</i>
<i>Lecidea aspidula</i> Kremp. (1880)	= <i>Protoparmelia petraeoides</i>
<i>Lecidea plana</i> Kremp. (1880) - nom. illegit.	= <i>Lecidea ochroleuca</i>
<i>Lecidea subnubila</i> Stirt. (1881)	= <i>Porpidia albocaerulescens</i>
<i>Lecidea diaphaenenta</i> Knight (1882)	= <i>Protoparmelia petraeoides</i>
<i>Lecidea enterophaea</i> Knight (1882)	- drawing only ! <i>P. leptocarpa</i> (?)
<i>Lecidea enteroxantha</i> Knight (1882)	= <i>Protoparmelia petraeoides</i>
<i>Lecidea microspora</i> Knight (1882) - nom. illegit.	= <i>Paraporpidia leptocarpa</i>
<i>Lecidea subpromiscua</i> Nyl. (1886)	= <i>Paraporpidia leptocarpa</i>
<i>Lecidea pelophaea</i> Nyl. (1886) - nom. illegit.	= <i>Protoparmelia petraeoides</i>
<i>Lecidea mundula</i> Müll.Arg. (1887)	= <i>Lecanora oreinoides</i>
<i>Lecidea buelliastrum</i> Müll.Arg. (1887)	= <i>Lecidella buelliastrum</i>
<i>Lecidea leioplaca</i> Müll.Arg. (1887)	= <i>Lecanora impressa</i>
<i>Psora endochlora</i> Müll.Arg. (1888)	= <i>Lecidea ochroleuca</i>
<i>Lecanora laevisissima</i> Knight in Shirley (1889)	= <i>Lecanora impressa</i>
<i>Psora psammophila</i> Müll.Arg. (1892)	= <i>Paraporpidia glauca</i>
<i>Lecidea crassilabra</i> Müll.Arg. (1893)	= <i>Lecidea crassilabra</i>
<i>Psora plicatula</i> Müll.Arg. (1893)	= <i>Protoparmelia plicatula</i>
<i>Lecidea tristicula</i> Müll.Arg. (1893)	= <i>Lecidella tristicula</i>
<i>Lecidea contigua</i> var. <i>umbonifera</i> Müll.Arg. (1893)	= <i>Porpidia umbonifera</i>
<i>Lecidea ferax</i> Müll.Arg. (1893)	= <i>Paraporpidia leptocarpa</i>
<i>Lecidea ferax</i> var. <i>athallina</i> Müll.Arg. (1893)	= <i>Paraporpidia leptocarpa</i>
<i>Lecidea fumosella</i> Müll.Arg. (1893)	= <i>Lecidea atromorio</i>

<i>Lecidea luehmanniana</i> Müll.Arg. (1893)	= <i>Paraporpidea leptocarpa</i>
<i>Lecidea nesophila</i> Müll.Arg. (1895)	= <i>Lecidella buelliastrum</i>
<i>Lecidea aspidula</i> var. <i>dispersa</i> Müll.Arg. (1895)	= " <i>Lecidea</i> " <i>aspidula</i> var. <i>dispersa</i>
<i>Lecidea ferax</i> var. <i>geographica</i> Müll.Arg. (1895)	= <i>Paraporpidea leptocarpa</i>
<i>Lecanora atra</i> var. <i>serialis</i> Müll.Arg. (1895)	= <i>Tephromela atra</i>
<i>Lecidea insulana</i> Müll.Arg. (1895)	= <i>Lecanora subcoarctata</i>
<i>Lecidea scorigena</i> Müll.Arg., (1895)	= <i>Biatora scorigena</i>
<i>Lecidea selenospora</i> Müll.Arg. (1895)	- not identifiable
<i>Lecidea nodulosa</i> Stirt (1899)	= <i>Lecidea terrena</i>
<i>Lecidea brachysporoides</i> Räs. (1944)	= <i>Lecidea terrena</i>
<i>Lecidea leptoplacoides</i> Räs. (1949)	= <i>Paraporpidea leptocarpa</i>
<i>Lecidea ramosella</i> Räs. (1949)	= <i>Paraporpidea leptocarpa</i>
<i>Lecidea korundensis</i> Räs. (1949)	= <i>Tephromela atra</i>
<i>Lecanora atra</i> var. <i>australiana</i> Räs. (1949)	= <i>Tephromela atra</i>
<i>Lecidea wilsonii</i> Räs. (1949)	= <i>Lecanora immersa</i>
<i>Lecidea leptocarpa</i> var. <i>terrigena</i> Räs. (1949)	= <i>Lecidea ochroleuca</i>

3.7. Abbreviations and contractions

The following abbreviations are used in the key, the descriptions and the lists of collecting localities:

A.C.T. (Australian Capital Territory), **C** (saturated solution of calcium hypochlorite), **E** (East), **ft** (feet), **Hwy** (Highway), **I** (iodine solution, Lugol's solution), **Iconc.** (concentrated iodine solution), **K** (10% solution of potassium hydroxide), **leg.** (legit, collected by), **mi** (mile, miles), **Mt** (Mount), **Mtn** (Mountain), **N** (North), **N.S.W.** (New South Wales), **N.T.** (Northern Territory), **N.Z.** (New Zealand), **P** (ethanolic solution of *p*-phenylenediamine); **Qld** (Queensland), **S** (South), **S.A.** (South Australia), **S. Afr.** (South Africa), **Tas.** (Tasmania), **TLC** (thin layer chromatography), **Vic.** (Victoria), **W** (West), **W.A.** (Western Australia).

3.8. Artificial key to the species

1a	Hypothecium colourless or pale brownish	2
1b	Hypothecium yellowish-brown to brownish-black	49
2a (1a)	Medulla I + deep violet	3
2b	Medulla I - or + pale violet	4
3a (2a)	Thallus whitish, greyish to rusty coloured, rimose to areolate, apothecia sessile to subimmersed, excipulum K+ yellow or red (stictic acid or norstictic acid)	
	 <i>Lecidea lapicida</i> (p. 210)	

3b	Thallus brownish, areolate, apothecia immersed, excipulum K- (confluent acid and/or 2'-O-methylperlatolic acid)	<i>Immersaria athroocarpa</i> (p. 240)
4a (2b)	Apothecia immersed into or between the areoles	5
4b	Apothecia sessile	23
5a (4a)	Thallus white, whitish to yellow or not obvious	6
5b	Thallus red, brownish to black	15
6a (5a)	Thallus yellow, excipulum blackish-brown; usnic acid present	<i>Poeltiaria coromandelica</i> (p. 265)
6b	Thallus not yellow, excipulum not blackish-brown or reduced; usnic acid deficient	7
7a (6b)	Disc of apothecia and/or epihymenium brownish to reddish	8
7b	Disc of apothecia black	11
8a (7a)	Asci of " <i>Bacidia</i> -"/" <i>Lecanora</i> -type"; xanthonones and atranorin present, gyrophoric acid deficient	9
8b	Asci of " <i>Trapelia</i> -type"; excipulum, xanthonones and atranorin deficient, gyrophoric acid present	<i>Trapelia</i> sp. - [not treated in this study]
9a (8a)	Excipulum reduced; zeorin present; various xanthonones (along with chodatin and demethylchodatin)	<i>Lecanora impressa</i> (p. 94)
9b	Excipulum up to 70 μ m thick; zeorin not present	10
10a (9b)	Chodatin (+ demethylchodatin) present	<i>Lecidella chodati</i> (p. 112)
10b	Chodatin (+ demethylchodatin) not present	<i>Lecidella enteroleucella</i> (p. 110)
11a (7b)	Hymenium colourless	12
11b	Hymenium violet to pale reddish	14
12a (11a)	Apothecia 0.3 - 0.8 mm diam.	13
12b	Apothecia 0.7 - 1.5 mm diam.; fatty acids present	<i>Lecanora demersa</i> (p. 90)
13a (12a)	Subhypotheical medulla colourless, thallus containing atranorin, confluent acid, disc persistently plane	<i>Lecanora oreinoides</i> (p. 100)
13b	Subhypotheical medulla colourless to pale brownish; xanthonones present, disc subconvex to convex	<i>Lecidella buelliastrum</i> (p. 107)
14a (11b)	α -Collatolic acid, alectoronic acid present	<i>Tephromela atra</i> (p. 150)
14b	Glomelliferic acid, perlatolic acid present; restricted to Northern Australia	<i>Tephromela arafurensis</i> (p. 145)
15a (5b)	Asci without distinct tholus (" <i>Schaereria</i> -type")	16
15b	Asci with more or less well developed tholus	17

16a (15a)	Spores globular, epihymenium brownish	
	 <i>Schaereria xerophila</i> (p. 313)	
16b	Spores ellipsoid, epihymenium greenish	
	 <i>Schaereria fuscocinerea</i> (p. 310)	
17a (15b)	Thallus red, rarely blackish.....	<i>Tremolecia atrata</i> (p. 316)
17b	Thallus pale brownish to dark brown	18
18a (17b)	Spores large, 27 - 39 x 14 - 17 μ m, becoming dark brown, asci of " <i>Porpidia</i> - type", lacking lichen substances	<i>Poeltidea perusta</i> (p. 275)
18b	Spores smaller, asci not of " <i>Porpidia</i> -type".....	19
19a (18b)	Apothecia small, up to 0.2 mm diam., areoles up to 0.5 mm diam., subhypothecial medulla dark brown	<i>Clauzadeana macula</i> (p. 85)
19b	Apothecia 0.5 - 1.3 mm diam., areoles 0.3 - 3.0 mm diam., subhypothecial medulla not pigmented	20
20a (19b)	Thallus K + red (norstictic acid)	<i>Protoparmelia petraeoides</i> (p. 129)
20b	Thallus K-	21
21a (20b)	Spores curved to ellipsoid, asci of " <i>Fuscidea</i> -type"	
	 <i>Fuscidea</i> sp. - [not treated in this study]	
21b	Spores ellipsoid, asci not of " <i>Fuscidea</i> -type".....	22
22a (21b)	Thallus K- (lobaric acid and/or miriquidic acid), asci of " <i>Lecanora</i> -type"	<i>Miriquidica deusta</i> (p. 121)
22b	Thallus K + red (gyrophoric acid), asci of " <i>Trapelia</i> - type"	<i>Trapelia</i> sp. - [not treated in this study]
23a (4b)	Epihymenium brownish, red-brown to orange or not pig- mented	24
23b	Epihymenium olivaceous, green to black	31
24a (23a)	Thallus C + red (norstictic acid)	25
24b	Thallus C-	26
25a (24a)	Apothecia not distinctly marginate, epihymenium K-, thallus brownish-grey to pale brownish	<i>Protoparmelia petraeoides</i> (p. 129)
25b	Apothecia with more or less distinct margins, epihyme- nium K+ violet, thallus pale yellowish	<i>Pyrrospora sanguinolenta</i> (p. 141)
26a (24b)	Thallus sorediate or leprose-granular, apothecia small, disc yellow to brownish	27
26b	Thallus neither sorediate nor leprose-granular.....	28
27a (26a)	Thallus creamy white, with distinct soralia, restricted to northern Australia	<i>Biatora sorediosa</i> (p. 75)

27b	Thallus, yellow-green, leprose-granular	<i>Psilolechia lucida</i> (p. 230)
28a (26b)	Asci of " <i>Lecanora</i> -type"	29
28b	Asci not of " <i>Lecanora</i> -type"	30
29a (28a)	Apothecia "lecanorine" (to "biatorine"), thallus containing lobaric acid	<i>Protoparmelia badia</i> (p. 127)
29b	Apothecia "biatorine", thallus containing baeomycesic acid (major), squamatic acid and barbatic acid (traces)	<i>Protoparmelia plicatula</i> (p. 137)
30a (28b)	Asci of " <i>Fuscidea</i> -type", excipulum, thallus cortex C -	<i>Fuscidea</i> sp. - [not treated in this study]
30b	Asci of " <i>Trapelia</i> -type", excipulum, thallus cortex C + red (gyrophoric acid)	<i>Trapelia</i> sp. - [not treated in this study]
31 a (23b)	Apothecia distinctly marginate	32
31 b	Apothecia without distinct margins	45
32a (31 a)	Asci of " <i>Porpidia</i> -type" or of " <i>Lecidea</i> -type", spores halonate or not	33
32b	Tholus amyloid with "masse axiale" (" <i>Bacidia</i> -" / " <i>Lecanora</i> -type") or not distinct, spores not halonate	36
33a (32a)	Thallus yellow	<i>Poeltiaria coromandelica</i> (p. 265)
33b	Thallus not yellow	34
34a (33b)	Spores more than 5 μ m wide	35
34b	Spores less than 4 (- 5) μ m wide, containing planaic acid, 4-O-demethylplanaic acid	<i>Lecidea plana</i> (p. 222)
35a (34a)	Excipulum colourless, ectal zone greenish, epihymenium olivaceous to greenish, containing no substances or porphyritic acid	<i>Poeltiaria corralensis</i> (p. 268)
35b	Excipulum brownish, ectal zone blackish-brown, epihymenium brownish to greenish-brown, containing confluent acid	<i>Poeltiaria turgescens</i> (p. 272)
36a (32b)	Thallus greyish to brownish	37
36b	Thallus white, yellowish-whitish, greyish or not distinct	39
37a (36a)	Spores globular	<i>Schaereria xerophila</i> (p. 313)
37b	Spores ellipsoid	38
38a (37b)	Apothecia 0.4 - 1.5 mm diam., areoles 0.3 - 1.0 mm diam., thallus containing lobaric acid and/or miriquidic acid	<i>Miriquidica deusta</i> (p. 121)
38b	Apothecia 1.0 - 2.4 mm diam. [not developed in Australian material], thallus containing alectorialic acid (as major substance)	<i>Tephromela armeniaca</i> (p. 148)

39a (36b)	Thallus and/or thalline margin of apothecia yellowish-whitish, containing usnic acid (alpine species)	40
39b	Thallus creamy whitish to white, lacking usnic acid (alpine or lowland species)	41
40a (39a)	Apothecia black, pruinose; atranorin present	
	 <i>Lecanora marginata</i> (p. 97)	
40b	Apothecia pale brownish; atranorin deficient, zeorin and fatty acid (rangiformic acid ?) present	
	 <i>Lecanora polytropa</i> (p. 104)	
41a (39b)	Growing on coastal, non-calcareous rock; atranorin present	42
41b	Growing in alpine or in lowland habitats on siliceous or calcareous rock; atranorin present or not	43
42a (41a)	Spores 8 - 14 x 4 - 5 μ m, 0 - 1 - septate; lecideoidin or gangaleoidin present	
	 <i>Thylothallia pahiensis</i> (p. 155)	
42b	Spores 5 - 10 μ m broad, non-septate; zeorin and arthothelin present	
	 <i>Lecanora subcoarctata</i> (p. 319)	
43a (41b)	Miriquidic acid present, zeorin deficient; tholus without amyloid zone above masse axiale	
	 <i>Miriquidica leucophaea</i> (p. 124)	
43b	Zeorin present or deficient; tholus with amyloid zone above masse axiale	44
44a (43b)	Spores ellipsoid, 13 - 17 x (5 -) 6 - 9 μ m, outer amyloid ascus wall thick (c. 1 - 2 μ m)	
	 <i>Lecidella stigmatea</i> (p. 112)	
44b	Spores ellipsoid to curved, 10 - 13.5 x 4 - 5 μ m, outer ascus wall relatively thin (c. 0.1 μ m)	
	 <i>Biatora scorigena</i> (p. 73)	
45a (31b)	Hymenium reddish to violet	
	 <i>Tephromela atra</i> (p. 150)	
45b	Hymenium not pigmented	46
46a (45b)	Norstictic acid present, atranorin and xanthonenes deficient, paraphyses 4 - 5 μ m thick, growing in alpine habitats (from c. 1800 m up) ..	
	 <i>Austrolecia antarctica</i> (p. 70)	
46b	Atranorin and xanthonenes present, norstictic acid deficient; paraphyses c. 2 μ m thick, growing at lower altitudes	47
47a (46b)	Hypothecium colourless to pale brown; caloploicin and diploicin present	
	 <i>Lecidella buelliastrum</i> (p. 107)	
47b	Hypothecium colourless, caloploicin and diploicin deficient	48
48a (47b)	Chodatin present	
	 <i>Lecidella chodati</i> (p. 112)	
48b	Chodatin deficient	
	 <i>Lecidella enteroleucella</i> (p. 110)	
49a (1b)	Medulla I + intense violet	50

49b	Medulla I - to pale violet	59
50a (49a)	Apothecia immersed, areoles brownish.....	51
50b	Apothecia sessile to subimmersed, areoles brownish or not	52
51a (50a)	Hymenium 85 - 125 μm tall, spores 13 - 20 x 6 - 12 μm <i>Immersaria athrocarpa</i> (p. 240)	
51b	Hymenium 30 - 65 μm tall, spores 8 - 10.5 x 4 - 5 μm <i>Lecidea fuscoatrula</i> (p. 173)	
52a (50b)	Spores more than 5 μm wide	53
52b	Spores less than 5 μm wide	56
53a (52a)	Asci of " <i>Rimularia</i> -type, apothecia often gyrodisc, medulla mostly brown	<i>Rimularia psephota</i> (p. 307)
53b	Asci not of " <i>Rimularia</i> -type, apothecia $\pm$ roundish, medulla not pigmented	54
54a (53b)	Thallus, excipulum K+ yellow or K+ yellow, then red (stictic acid, norstictic acid), asci of " <i>Lecidea</i> -type" <i>Lecidea lapicida</i> (p. 210)	
54b	Thallus, excipulum K-, asci of " <i>Porpidia</i> -type"	55
55a (54b)	Inner zone of excipulum pale brownish, lacking substances	<i>Porpidia umbonifera</i> (p. 296)
55b	Inner zone of excipulum dark brownish, containing confluent acid (major substance)	<i>Porpidia speirea</i> (p. 293)
56a (52b)	Areoles brown, cortex with a thick epinecral layer <i>Lecidea atrobrunnea</i> (p. 199)	
56b	Areoles not brown, epinecral layer developed or not	57
57a (56b)	Spores 3 - 4.5 μm broad, subhymenium (greenish to) colourless	58
57b	Spores 2.5 - 3.0 μm broad, subhymenium greenish	<i>Lecidea diducens</i> (p. 208)
58a (57a)	Containing perlatolic acid (major substance), anziaic acid	<i>Lecidea cerviniicola</i> (p. 202)
58b	Containing confluent acid (major substance)	<i>Lecidea promiscens</i> (p. 224)
59a (49b)	Thallus brown	60
59b	Thallus not brown or not obvious	64
60a (59a)	Asci of " <i>Rimularia</i> -type", paraphyses often branched and anastomosing	61
60b	Asci of " <i>Lecidea</i> -type", paraphyses only occasionally branched and anastomosing	62
61a (60a)	Parasite on <i>Lecanora rupicola</i> agg. <i>Rimularia insularis</i> (p. 304)	

61b	Growing independently of other lichens	
	 <i>Rimularia exigua</i> (p. 302)	
62 a (60b)	Apothecia 0.3 - 0.5 mm diam., immersed	
	 <i>Lecidea atromorio</i> (p. 165)	
62b	Apothecia 0.5 - 1.8 mm diam., sessile to subimmersed	63
63a (62b)	Containing confluent acid or no substance	
	 <i>Lecidea tragorum</i> (p. 196)	
63b	Containing 2'-O-methylperlatolic acid	
	 <i>Lecidea capensis</i> (p. 168)	
64a (59b)	Asci of " <i>Porpidia</i> -type" or " <i>Micarea</i> -type"	65
64b	Asci not of " <i>Porpidia</i> - type" or " <i>Micarea</i> -type"	73
65a (64a)	Thallus sorediate, containing stictic acid (and a fatty acid)	
	 <i>Porpidia soredizodes</i> (p. 291)	
65b	Thallus not sorediate, containing stictic acid or not	66
66a (65b)	Apothecia small, 0.2 - 0.4 mm diam., spores 5 - 7 x 2 - 3 μ m	
	 <i>Micarea erratica</i> (p. 227)	
66b	Apothecia and spores larger	67
67a (66b)	Excipulum K + yellow or red (stictic acid and/or norstictic acid)	68
67b	Excipulum K-	69
68a (67a)	Excipulum brownish, apothecia sessile, thallus thin, rimose-areolate, whitish, creamy to rusty coloured	
	 <i>Porpidia crustulata</i> (p. 285)	
68b	Excipulum not pigmented, apothecia subimmersed to immersed, thallus rimose-areolate, grey	
	 <i>Porpidia albocaerulescens</i> (p. 278)	
69a (67b)	Inner zone of the excipulum pale brownish or not pigmented, containing confluent acid or 2'-O-methylperlatolic acid, growing in (semi-) arid areas	
	 <i>Paraporpidia glauca</i> (p. 246)	
69b	Excipulum dark brown	70
70a (69b)	Hymenium 50 - 70 (- 80) μ m tall, not growing in alpine habitats	71
70b	Hymenium 70 - 120 μ m tall, growing in alpine habitats ...	72
71a (70a)	Margin of apothecia indistinct, thallus containing 2'-O-methylmicrophyllinic acid, restricted to central Australia	
	 <i>Paraporpidia aboriginum</i> (p. 244)	
71b	Margin of apothecia distinct, thallus containing confluent acid and/or 2'-O-methylperlatolic acid, not occurring in central Australia	
	 <i>Paraporpidia leptocarpa</i> (p. 250)	

72a (70b)	Containing methyl 2'-O-methylmicrophyllinate, thallus mostly whitish	<i>Porpidia contraponenda</i> (p. 282)
72b	Containing no substance, thallus whitish, greyish or rusty coloured	<i>Porpidia macrocarpa</i> (p. 288)
73a (64b)	Asci of " <i>Lecidea</i> -type"	74
73b	Asci not of " <i>Lecidea</i> -type"	81
74a (73a)	Excipulum K + yellow or K+ yellow then red or K-; conidia filiform (longer than 8.5 μ m), growing in alpine habitats	75
74b	Excipulum K-; conidia cylindrical, (up to 8.5 μ m), growing in non-alpine habitats	77
75a (74a)	Spores 3 - 4 μ m broad, thallus containing planaic acid and 4-O-demethylplanaic acid	<i>Lecidea plana</i> (p. 222)
75b	Spores 5 - 9 μ m broad	<i>Lecidea lygomma</i> <u>agg.</u> :
76a	Containing norstictic acid or lacking substances	<i>Lecidea lygomma</i> (p. 214)
76b*	Containing stictic acid	<i>Lecidea crassilabra</i> (p. 205)
76c	Containing porphyritic acid	<i>Lecidea lygommoides</i> (p. 219)
77a (74b)	Spores 2.8 - 4 μ m broad, hymenium and inner zone of the excipulum reddish or not, lacking substances	<i>Lecidea sarcogynoides</i> (p. 185)
77b	Spores 4 - 8 μ m broad, hymenium greenish to colourless	<i>Lecidea ochroleuca</i> <u>agg.</u> :
78a	Containing no lichen substances	79
78b	Containing lichen substances	80
79a (78a)	Saxicolous	<i>Lecidea terrena</i> (p. 189)
79b	Terricolous	<i>Lecidea ochroleuca</i> (p. 176)
80a (78b)	Containing confluent acid	<i>Lecidea terrena</i> (p. 189)
80b	Containing gyrophoric acid	<i>Lecidea ochroleuca</i> (p. 176)
81a (73b)	Hypothecium dark brown; atranorin deficient	82
81b	Hypothecium yellow-brown to pale brown; atranorin present or not	85
82a (81a)	Thallus blackish-grey, cortex C + red (gyrophoric acid), epihymenium brownish, ascus of " <i>Rimularia</i> -type"	<i>Rimularia australis</i> (p. 300)
82 b	Thallus creamy whitish to white or not distinct, cortex C-, epihymenium greenish, ascus of " <i>Lecanora</i> -type" or of " <i>Catillaria</i> - type"	83
83a (82b)	Thallus distinct, containing lichen substances	84
83b	Thallus mostly indistinct, containing no substances	<i>Carbonea vorticosa</i> (p. 83)

84a (83a)	Containing xanthonenes	<i>Lecidella sublapicida</i> (p. 116)
84b	Containing norstictic acid	<i>Austrolecia antarctica</i> (p. 70)
85a (81b)	Hypothallus well developed, black, obvious at the thallus margin and/or between the areoles; fatty acids present	<i>Lecanora demersa</i> (p. 90)
85b	Hypothallus absent or inconspicuous; fatty acids deficient	86
86a (85b)	Outer amyloid ascus wall thick (c. 0.8 - 2.0 μ m); xan- thonenes present, 2'-O-methylperlatolic acid deficient	87
86b	Outer amyloid ascus wall thin (c. 0.1 - 0.2 μ m), 2'-O-me- thylperlatolic acid present, xanthonenes deficient	<i>Carbonea montevidensis</i> (p. 79)
87a (86a)	Caloploicin and diploicin deficient, xanthonenes present	<i>Lecidella sublapicida</i> (p. 116)
87b	Caloploicin and diploicin present	<i>Lecidella buelliastrum</i> (p. 107)

3.9. Enumeration of the families, genera and species

(* : typically non-lecideoid species, which facultatively develop
lecideoid forms)

Catillariaceae Hafellner

Austrolecia Hertel

A. antarctica Hertel

Lecanoraceae Fée

Biatora Fr.

B. scorigena (Müll.Arg.) Rambold comb. nov.; *B. solediosa* Rambold sp.
nov.

Carbonea (Hertel) Hertel

C. montevidensis (Müll.Arg.) Rambold & Knoph comb. nov.; *C. vorticosa*
(Flk.) Hertel.

Clauzadeana Roux

C. macula (Th.Tayl.) Coppins & Rambold comb. nov.

Lecanora Ach.

L. demersa (Kremp.) Hertel & Rambold comb. nov.; *L. impressa* Kremp.;
L. marginata (Schaer.) Hertel & Rambold, *L. oreinoides* (Koerb.) Hertel &
Rambold comb. nov.; **L. polytropa* (Ehrh.) Rabenh.

Lecidella

L. buelliastrum (Müll.Arg.) Knoph & Rambold comb. nov.; *L. enteroleu-
cella* (Nyl.) Hertel; *L. stigmathea* (Ach.) Hertel & Leuck.; *L. sublapicida*
(Knight) Hertel.

Miriquidica Hertel & Rambold

M. deusta (Stenham.) Hertel & Rambold; *M. leucophaea* (Flk. ex Rabenh.) Hertel & Rambold.

Protoparmelia Choisy

**P. badia* (Hoffm.) Hafellner; *P. petraeoides* (Bab. & Mitt.) Hertel; *P. plicatula* (Müll.Arg.) Rambold comb. nov.

Pyrrhospora Koerb.

P. sanguinolenta (Kremp.) Rambold & Hafellner comb. nov.

Tephromela Choisy

**T. arafurensis* Rambold sp. nov.; *T. armeniaca* (DC.) Hertel & Rambold;

**T. atra* (Huds.) Hafellner.

Tylothallia P. James & Kiliass

T. pahiensis (Zahlbr.) Hertel & Kiliass.

Lecideaceae Chevalier

Lecidea Ach.

subg. *Lecidea*

L. atromorio Knight; *L. capensis* Zahlbr.; *L. fuscoatrula* Nyl.; *L. ochroleuca* Pers.; *L. sarcogynoides* Koerb.; *L. terrena* Nyl.; *L. tragorum* Zahlbr.

subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann comb. nov.

L. atrobrunnea (Lam. & DC.) Schaer.; *L. cerviniicola* B. de Lesd.; *L. crassilabra* Müll.Arg.; *L. diducens* Nyl.; *L. lapicida* (Ach.) Ach.; *L. lygomma* Nyl.; *L. lygommoides* Rambold sp. nov.; *L. plana* (Lahm) Nyl.; *L. promiscens* Nyl.

Micareaceae Hafellner

Micarea Fr.

M. erratica (Koerb.) Hertel, Rambold & Pietschmann comb. nov.

Psilolechia Massal.

P. lucida (Ach.) Choisy.

Porpidiaceae Hertel & Hafellner

Immersaria Rambold & Pietschmann gen. nov.

I. athroocarpa (Ach.) Rambold & Pietschmann comb. nov.

Paraporpidia Rambold & Pietschmann gen. nov.

P. aboriginum Rambold sp. nov.; *P. glauca* (Th.Tayl.) Rambold comb. nov.;

P. leptocarpa (Bab. & Mitt.) Rambold & Hertel comb. nov.

Poeltiaria Hertel

P. coromandelica (Zahlbr.) Rambold & Hertel comb. nov.; *P. corralensis* (Räs.) Hertel; *P. turgescens* (Koerb.) Hertel.

Poeltidea Hertel & Hafellner

P. perusta (Nyl.) Hertel & Hafellner.

Porpidia Koerb.

P. albocaulerulascens (Wulfen) Hertel & Knoph var. *albocaulerulascens*; *P. albocaulerulascens* var. *polycarpiza* (Vain.) Rambold & Hertel comb. nov.; *P. contraponenda* (Arnold) Knoph & Hertel; *P. crustulata* (Ach.) Hertel & Knoph; *P. macrocarpa* (DC.) Hertel & Schwab; *P. soredizodes* (Lamy) Knoph, Hertel & Rambold comb. nov.; *P. speirea* (Ach.) Kremp.; *P. umbo-nifera* (Müll.Arg.) Rambold comb. nov.

Rimulariaceae Hafellner

Rimularia Nyl.

R. australis Hertel & Rambold, *R. exigua* Hertel & Rambold; *R. insularis* (Nyl.) Rambold & Hertel; *R. psephota* (Tuck.) Hertel & Rambold.

Schaereriaceae Hafellner

Schaereria Koerb.

Sch. fuscocinerea (Flot.) Clauzade & Roux; *Sch. xerophila* Rambold & Mayrhofer sp. nov.

Tremoleciaceae Hafellner

Tremolecia Choisy

T. atrata (Ach.) Hertel.

Catillariaceae Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 271 - 272 (1984).

Type: *Catillaria* Massal.

According to the concept of HAFELLNER (1984), the Catillariaceae comprise only the genus *Catillaria*. HERTEL (1984: 452) included the genus *Austrolecia* into this family with regard to the ascus type. ERIKSSON & HAWKSWORTH (1987b) and HERTEL & RAMBOLD (1988) subsequently suggested the inclusion of the Placolecidaceae Hafellner, with the monotypic genus *Placolecis* Trevis. into the Catillariaceae.

Austrolecia Hertel

HERTEL, Beih. Nova Hedwigia **79**: 452 - 453 (1984).

Typus generis: *A. antarctica* Hertel - (holotype).

This monotypic genus is characterized by asci of the "*Catillaria* -type", non- to 1-septate spores and thick-walled paraphyses. Its inclusion into the Catillariaceae must be regarded as preliminary. Asci with a homogenously amyloid tholus occur in genera, which show diverse relationships (aside from the genera of the Catillariaceae, e.g. in *Brigantiaea*, *Maronella*, *Megalospora* or in *Sporastatia*). It seems possible, that the asci of *Austrolecia* may represent a "*Lecanora*-type" with a reduced masse axiale. This would indicate a relationship to *Tephromela* (Lecanoraceae).

Austrolecia antarctica Hertel

HERTEL, Beih. Nova Hedwigia **79**: 453 - 454 (1984); Mitt. Bot. Staats-samml. München **23**: 323 (1987).

Type: ANTARCTICA: South Shetland Islands, King George Island, Admiralty Bay area, Sphinx Hill, 100 m, on northern slope on bare rocks, 5.i.1980, leg. R.Ochyra 260/80 (M!, holotype) - [containing norstictic acid].

DESCRIPTION:

Thallus: areolate to bullate-areolate, up to 35 mm diam., 0.5 - 1.5 mm thick.

AREOLES: irregularly roundish, white to creamy white, subconvex to convex, with smooth to rough surface, c. 1 mm, max. 1.7 - 2 mm diam. Cortex 15 - 20 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer 30 µm thick. Algal layer c. 90 - 100 µm

thick; algal cells c. 9 - 10 μm , max. 13 μm diam. Medulla I -; hyphae 3.5 - 4 μm thick.

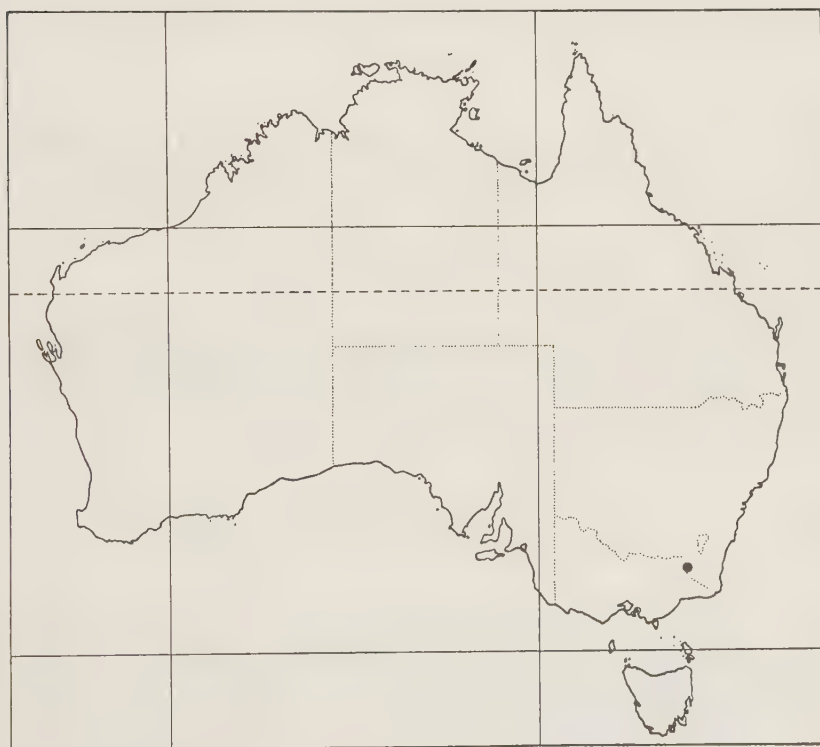
HYPOTHALLUS: obvious between the areoles and at the thallus margin.

Apothecia: irregularly shaped, crowded, 12 - 15/cm², sessile, not constricted at the base, c. 1 mm, max. 1.6 mm diam. Disc subconvex to convex, black, nitid, epruinose. Margin not distinct.

EXCIPULUM: max. 50 - 100 μm , lateral of hymenium 50 - 100 μm thick. Ectal zone dark green; pigmentation diffuse; hyphae 5 - 7 μm diam., with lumina of 1.5 - 2 μm . Inner zone grey-green; hyphae 5 - 6 μm diam., with lumina of 1.5 μm . Medullary zone not developed.

HYPOTHECIUM: pale brown to violet-brown, 130 - 200 μm thick; hyphae 5 - 8 μm diam.; subhymenial layer colourless.

HYMENIUM: c. 70 μm tall, more or less tinged grey-green to green, I+ blue, Iconc -. Epihymenium dark green, diffuse. Paraphyses branched



Map 2. Distribution of *Austrolecia antarctica* in continental Australia

and anastomosing, 4 - 6 μ m, apical 5 - 6 μ m thick. Asci c. 50 - 65 x 11 - 16 μ m; tholus max. 5 - 15 μ m, min. 4 - 10 μ m thick; outer amyloid wall layer 1.5 - 2 μ m thick, I+ brown, Iconc. + red-brown; non-amyloid wall layer 0.5 - 0.8 μ m thick. Spores ellipsoid, non- to 1-septate, 11 - 17 x 4 - 6 μ m.

Pycnidia: subimmersed. Conidia cylindrical, 5 - 6 x 1 - 1.2 μ m.

CHEMISTRY:

Cortex K+ red, P± orange, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing norstictic acid, connorstictic acid (6 specimens examined).

DISTRIBUTION:

Austral. New to Australasia! *A. antarctica* is hitherto only known from Antarctic Peninsula and King George Island (Antarctica). Within continental Australia it is restricted to the Snowy Mountains in N.S.W. (map 2), growing on exposed siliceous rocks. The species is also expected to be found in Tasmania.

NOTES:

HERTEL (1984) reported a colourless hypothecium for this species. However, the type material as well as the Australian specimens show a pale brown to dark violet-brown pigmentation of the hypothecial zone.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Spencers Creek, 2 km E of Charlottes Pass, 36°25'S, 148°21'E, 1750 - 1800 m, 23.i.1984, leg. P. W. James (BM, 2 specimens); -- Kosciusko National Park, Spencers Creek, 2 km E of Charlottes Pass, 36°25'S, 148°21'E, 1800 m, 23.i.1984, leg. J.A. Elix 11686 (ANUC); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G. Rambold 3487, 3503, 3508 (M).

Lecanoraceae Fée emend. Hafellner

FÉE, Essai, Crypt.: XLVIII (1824); HAFELLNER, Beih. Nova Hedwigia **79**: 290 - 291 (1984).

Type: *Lecanora* Ach.

= **Biatoraceae** Massal. ex Stiz.

STIZENBERGER, Ber. Thätigk. St. Gallischen Naturwiss. Ges. 1861/62: 163 (1862); HAFELLNER, Beih. Nova Hedwigia **79**: 266 - 269 (1984).

Type: *Biatora* Fr. (1817) nom. cons. prop. (non *Biatora* Ach. 1809) - compare HERTEL (1967: 124), HAFELLNER (1984: 268).

= Tephromelataceae Hafellner

HAFELLNER, Beih. Nova Hedwigia 79: 344 (1984).

Type: *Tephromela* Choisy

The concept of the Lecanoraceae promulgated by HAFELLNER (l.c.) is quite narrow. According to this author, the species of the Lecanoraceae differ from the Biatoraceae and the Tephromelataceae mainly because they lack an amyloid zone between the "masse axiale" and the external wall layer (fig. 2a, b). As far as this feature is concerned, *Lecidella* closely resembles more the genus *Biatora*, which also has chemical similarities. In *Lecanora* s.l., e.g. in the *Lecanora marginata* - group, asci of the "*Biatora* -type" could be observed. The genus *Heppsora*, based on *H. indica* [= *Tephromela atra* s.l.], was placed into the Lecanoraceae by HAFELLNER (l.c.), while the same author created a further family, the Tephromelataceae for *Tephromela*. As a consequence of this, the Biatoraceae and Tephromelataceae are now included into the Lecanoraceae.

Biatora Fr. - nom. cons. prop. (non *Biatora* Ach. 1809)

FRIES, Lich. Dian. Nova: 7 - 8 (1817); HAFELLNER, Beih. Nova Hedwigia 79: 266 - 268.

Typus generis: *Biatora vernalis* (L.) Fr. - (lectotype - designated in CLEMENTS & SHEAR 1931).

The size and generic delimitation of *Biatora* is actually rather unclear. Most of the species belonging to this genus grow on organic substrata. Studies in corticolous lecideoid species revealed several taxa, belonging to *Biatora* s.str., but a number of representatives with other relationships have also been recognized (RAMBOLD unpubl.).

Within the Lecanoraceae, *Biatora* is defined by lecanorine asci with an amyloid zone above the masse axiale, relatively thin-walled paraphyses, non-septate spores, and filiform conidia.

Biatora scorigena (Müll.Arg.) Rambold comb. nov.

= *Lecidea scorigena* Müll.Arg., Hedwigia 34: 30 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 687 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 50 (1983); Checklist Austr. Lich. 2. ed.: 63 (1986); Austr. Fl. Fauna Ser. 4: 129 (1986); Checklist Austr. Lich. 3. ed.: 20, 106 (1988).

Type: AUSTRALIA: Victoria: [no locality, probably Little River], [comm.] 1893, leg. F.R.M. Wilson (GI, holotype; NSW 1435 [(n.v.) vide FILSON 1986b]; MEL 6931!, "isotypes" [coll. 1887]) - [not analyzed chemically].

DESCRIPTION:

Thallus: verrucose, c. 0.2 mm thick.

AREOLES: irregularly shaped, grey-brown, more or less plane, with rough surface, c. 0.2 mm diam. Cortex: upper cell layer not pigmented; epinecral layer not developed. Algal cells c. 10 - 12 μ m, max. 15 μ m diam. Medulla I -.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed, 10 - 15/cm², sessile, not constricted at the base, c. 0.3 - 0.4 mm, max. 0.6 mm diam. Disc plane to sub-plane, black, matt to subnitid, epruinose. Margin not distinct.

EXCIPULUM: max. 50 - 60 μ m, lateral of hymenium c. 50 - 60 μ m thick. Ectal zone grey to green; pigmented zone c. 15 μ m tall; hyphae c. 5 - 7 μ m diam., with lumina of c. 1.8 - 3 μ m. Inner zone colourless to grey; hyphae 4 - 7 μ m diam., with lumina of 2 - 3 μ m. Medullary zone developed at the basal part of the excipulum, occasionally with algal cells.

HYPOTHECIUM: colourless, hyphae c. 4 μ m diam.; subhymenial layer colourless.

HYMENIUM: 40 - 45 μ m tall, colourless, I+ bluish, Iconc. -. Epihymenium grey-green, diffuse. Paraphyses branched and anastomosing, c. 1.5 μ m, apices 2.5 - 4 μ m thick. Asci c. 30 x 10 μ m; tholus max. 10 μ m, min. 2.5 μ m thick; amyloid zone above the masse axiale c. 3 μ m thick; outer amyloid wall layer c. 0.5 μ m thick, I+ blue, Iconc. + brown; non-amyloid wall layer c. 0.2 μ m thick. Spores ellipsoid to curved, 10 - 13.5 x 4 - 5 μ m.

Pycnidia: immersed. Conidia filiform, curved, 15 - 20 x 0.8 - 1 μ m.

CHEMISTRY:

Not analyzed chemically, because the type material is too small and poorly developed.

DISTRIBUTION:

Endemic? *B. scorigena* is only known from the type collection from Victoria (map 3). The species grows on siliceous rock.

NOTES:

B. scorigena is included into *Biatora*, showing an amyloid zone above the masse axiale, filiform conidia and immarginate apothecia.

SPECIMENS EXAMINED:

Victoria: [no locality], 1893, leg. F.R.M. Wilson (holotype of *Lecidea scorigena* Müll.Arg., G); -- Little River, [37°58'S, 144°30'E], 8.iv.1887, leg. F.R.M. Wilson ("isotype" of *Lecidea scorigena* Müll.Arg., MEL 6931).



Map 3. Distribution of *Biatora scorigena* in continental Australia

***Biatora solediosa* Rambold sp. nov.**

DIAGNOSIS:

Thallus crustaceus vel rimoso-areolatus, albus, cum soraliis, atranorinum et acidum 2'-O-methylperlatolicum continens. Apothecia ad 0.7 mm lata, marginata, subfusca. Hymenium et hypothecium incoloratum. Tholus amyloideus et massam axialem non amyloideam exhibens. Sporae ellipsoideae, unicellulares, non halonatae, circa 8 - 13 x 4 - 6 μ m.

Type: AUSTRALIA: Northern Territory: Robin Falls, 13 km SSE of Adelaide River, 13°21'S, 131°08'E, sandstone boulders beside creek, in monsoon forest, 80 m, 24.iii.1986, leg. G.Rambold 5155 (M, holotype; NT, isotype) - [containing atranorin, 2'-O-methylperlatolic acid and an unidentified substance].

DESCRIPTION:

Thallus: rimose, up to 70 mm diam., 0.1 - 0.2 mm thick, with distinct roundish soralia of 0.25 - 0.5 mm diam.

AREOLES: rimose, creamy whitish to pale grey, plane, with smooth to rough surface, c. 0.3 - 0.4 mm, max. 0.6 - 1.0 mm diam. Cortex 15 - 25 μ m thick; upper cell layer not pigmented; hyphae c. 3.5 - 4.5 μ m diam.; epinecral layer not developed. Algal layer c. 60 - 70 μ m thick; algal cells c. 8 - 9 μ m, max. 10 - 11 μ m diam. Medulla I -; hyphae 4 - 4.5 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: round, dispersed, up to 80/cm², sessile, constricted at the base, c. 0.4 mm, max. 0.6 - 0.7 mm diam. Disc more or less convex, pale yellow-brown, subnitid, epruinose. Margin first distinct, later mostly vanishing, yellowish-brownish, subnitid.

EXCIPULUM: max. 55 - 65 μ m, lateral of hymenium 45 - 55 μ m thick. Ectal zone not pigmented; hyphae 4 - 4.5 μ m diam., with lumina of c. 1.2 μ m. Inner zone colourless; hyphae parallel radiate, branched and anastomosing, 4 - 5 μ m diam., with lumina of 1.2 - 1.5 μ m. Medullary zone not obvious.

HYPOTHECIUM: colourless, hyphae c. 3.5 - 4 μ m diam.; subhymenial layer colourless.

HYMENIUM: c. 35 - 40 μ m tall, colourless, I -, Iconc. -. Epihymenium pale brown or colourless, up to 5 μ m tall. Paraphyses mostly not branched or anastomosing, 1.8 - 2 μ m, apices 1.5 - 3 μ m thick. Asci c. 30 x 12 μ m; tholus max. c. 9 μ m, min. 2 - 7 μ m thick; masse axiale c. 2 μ m broad; amyloid zone above masse axiale not obvious; outer amyloid wall layer c. 0.5 - 1 μ m thick, I+ brown, Iconc. + red-brown; non-amyloid wall layer c. 1 μ m thick. Spores ellipsoid, 8 - 13 x 4 - 6 μ m.

Pycnidia: immersed. Conidia filiform, c. 16 - 19 x 1 μ m.



Fig. 4. *Biatora solediosa*. (GR 5155, M) Scale = 1 mm.

CHEMISTRY:

Cortex K+ yellow, P+ yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing atranorin and 2'-O-methylperlatolic acid and an unknown substance (7 specimens examined).

DISTRIBUTION:

Endemic (or western pacific, eastern Asian, or palaeotropical?). *B. solediosa* occurs in the northern part of Western Australia and Northern Territory (map 4). It is often associated with *Tephromela arafurensis* and grows on sheltered rock faces, e.g. in open grassland or in monsoon forests.

NOTES:

The species probably is closely related to the non-soledious "*Lecidea*"



Map 4. Distribution of *Biatora solediosa* in continental Australia

aspidula var. *dispersa* Müll.Arg. which has been described from Thursday Island and is only known from the type collection (see under chapter 4.) *B. sorediosa* mostly develops sterile thalli and can easily be mistaken for a species of *Pertusaria*. All taxa of *Pertusaria*, which have been described from northern Australia are fertile or have, according to the original descriptions, a different thallus morphology. Furthermore there are no species of *Pertusaria* known which contain atranorin and 2'-O-methylperlatolic acid as the main substances, according to DIBBEN (1980) and HANKO (1983).

The specific epithet refers to the soredia, which are always developed.

SPECIMENS EXAMINED:

Western Australia: N.W.Kimberly, Prince Regent River Reserve, Garimbu Creek, 19.viii.1975, leg. K.F.Kenneally 2223 (PERTH); -- Hidden Valley National Park, 1.5 km NE of Kununurra, 15°46'S, 128°45'E, S facing sandstone cliffs near carpark, 80 m, 29.iii.1986, leg. G.Rambold 5258, 5264 (M); -- Kununurra, 2.5 km SE of town, 15°48'S, 128°46'E, W facing sandstone cliffs beside Duncan Highway, 60 m, 29.iii.1986, leg. G.Rambold 5247 (M); -- Mt Cockburn South, Cockburn Range, 45 km S of Wyndham, 15°55'S, 128°09'E, 300 m, 21.v.1988, leg. J.A.Elix 22448 (ANUC); -- King Leopold Range, gorge 3 km NW of Silent Grove, 63 km NE of the Lennard River crossing, along the Gibb River road, 17°06'S, 125°24'E, 350 m, 16.v.1988, leg. J.A.Elix 22258 (ANUC).

Northern Territory: Robin Falls, 13 km SSE of Adelaide River, 13°21'S, 131°08'E, sandstone boulders beside creek, in monsoon forest, 80 m, 24.iii.1986, leg. G. Rambold 5155 (M, NT); -- Stuart Hwy, Hayes Creek, 40 km NW of Pine Creek, 13°38'S, 131°35'E, 200 m, 8.v.1988, leg. J.A. Elix 22059 (ANUC); -- 23 km NE of Katherine, track from Katherine Gorge Campsite to Butterfly Gorge, 14°19'S, 132°25'E, sandstone rock walls and boulders beside walking track, 180 m, 20.iii.1986, leg. G. Rambold 5089 (M, NT), 5097, 5102 (M); -- 25 km NE of Katherine, Butterfly Gorge, 14°19'S, 132°27'E, sandstone boulders in monsoon forest, 200 m, 21.iii.1986, leg. G.Rambold 5122 (M); -- Victoria River, 1 km W of Victoria River Inn, 15°37'S, 131°09'E, E facing scree slope below sheer cliffs of mountain, on sandstone boulders, c. 80 m, 26.iii.1986, leg. G.Rambold 5199, 5207, 5214 (M).

Carbonea (Hertel) Hertel

HERTEL, Mitt. Bot. Staatssamml. München 19: 441 - 442 (1983); Beih. Nova Hedwigia 79: 442 (1984).

= *Lecidea* subg. *Carbonea* Hertel, Beih. Nova Hedwigia 24: 101 - 107 (1967).

Typus generis: *C. atronivea* (Arnold) Hertel - (holotype).

The generic name indicates that in the original circumscription the blackish pigmentation of the excipulum was regarded as the main characteristic feature of this genus. The species hitherto included in this genus usually occur in alpine habitats, growing on siliceous rocks. Four lichenicolous species are known, the delichenized *C. vitellinaria* (Nyl.) Hertel growing on saxicolous species of *Candelariella*, *C. superjecta*, parasitizing *Lecanora disjungenda*, *Carbonea su-*

persparsa (Nyl.) Hertel growing on *Lecanora polytropa* agg., and the lichenized, only facultatively lichenicolous species *C. assimilis* (Korrb.) Hafellner & Hertel.

With *C. montevidensis* the genus now also comprises a xerophilous taxon with non-carbonized excipula. *Carbonea* is well characterizable by asci of the "*Lecanora* -type" without any amyloid zone between the masse axiale and the rather thin outer ascus wall, by branched paraphyses with gelatinous walls, a greenish to blackish (not brownish) epihymenial pigmentation, and the lack of xanthones.

***Carbonea montevidensis* (Müll.Arg.) Rambold & Knoph comb. nov.**

= *Lecidea montevidensis* Müll.Arg., Rev. Mycol. (Toulouse) 10: 4 (1888); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 639 (1925); 10: 316 (1940); OSORIO, Com. Bot. Mus. Hist. Nat. Montevideo 56 (4): 19 (1972); Com. Bot. Mus. Hist. Nat. Montevideo 73 (4): 45 (1987).

Type: URUGUAY: Montevideo, 1887, leg. J.de Arechevaleta (G, holotype; G, W, M, isotypes) - [containing atranorin, chloro-atranorin (trace), 2'-O-methylperlatolic acid, according to KNOPH in litt.].

DESCRIPTION:

Thallus: verrucose to areolate, up to several cm diam., 0.1 - 0.8 mm thick.

AREOLES: irregularly shaped, whitish, plane to convex, with rough surface, c. 0.2 - 0.6 mm, max. 0.5 - 2.4 mm diam. Cortex up to c. 20 µm thick; upper cell layer not pigmented; hyphae c. 4 µm diam.; epinecral layer not developed. Algal layer up to 150 µm thick; algal cells c. 10 µm, max. c. 15 µm diam. Medulla I -; hyphae c. 4 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: irregular to roundish, auriculate, dispersed to crowded, 35 - 150/cm², sessile, more or less constricted at the base, c. 0.5 - 0.8 mm, max. 0.7 - 1.4 mm diam. Disc plane to convex, black, matt, epruinose. Margin distinct and mostly persistent, black, nitid.

EXCIPULUM: max. 50 - 90 µm, lateral of hymenium 40 - 80 µm thick.

Ectal zone grey-green to grey-brown; pigmentation diffuse; hyphae 3 - 6 µm diam., with lumina of 1 - 2 µm. **Inner zone** greyish, dark grey-brown to orange; hyphae parallel radiate, c. 4 - 5 µm diam., with lumina of 1 - 1.5 µm. **Medullary zone** not obvious.

HYPOTHECIUM: orange, 120 - 200 (- 250) µm thick; hyphae 4 - 4.5 µm diam.; subhymenial layer colourless, 30 - 55 µm thick.

HYMENIUM: 50 - 70 µm tall, colourless, I+ blue, Iconc. ± blue. **Epihymenium** grey-green to green, 10 - 20 µm tall. **Paraphyses** mostly branched and anastomosing, 1.5 - 2 µm, apices 3 - 4 µm thick. **Asci** c. 40 - 65 x 10 - 15 µm; **tholus** max. 9 - 10 µm, min. 3 - 6 µm thick; **masse axiale** up to 3.5 µm broad; **amyloid zone** above **masse axiale** not obvious; **outer amyloid wall layer** c. 0.1 µm thick, I-, Iconc. + brown; **non-amyloid wall layer** c. 0.1 µm thick. **Spores** ellipsoid, 11 - 12.6 - 13.4 - 15 x 5.5 - 6.1 - 7.3 - 9 µm.

Pycnidia: immersed. Conidia filiform, curved, c. $10 - 20 \times 0.8 - 1 \mu\text{m}$.

CHEMISTRY:

Cortex K+ yellow, P± yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

Three chemotypes observed:

- a) containing atranorin, 2'-O-methylperlatolic acid (39 specimens examined);
- b) containing atranorin, 2'-O-methylperlatolic acid and traces of gyrophoric acid (6 specimens examined);
- c) containing atranorin, 2'-O-methylperlatolic acid and traces of norstictic acid (2 specimens examined).

DISTRIBUTION:

Southern xeric. *C. montevidensis* is known from Argentina and Uruguay (OSORIO 1972: 19, 1987: 4), in several collections from South Africa (HAIDUK pers. comm.) and from continental Australia. There, it occurs in temperate to semi-arid regions of S.A., Qld, N.S.W., A.C.T. and Vic. (map 5), growing on more or less exposed siliceous rocks.

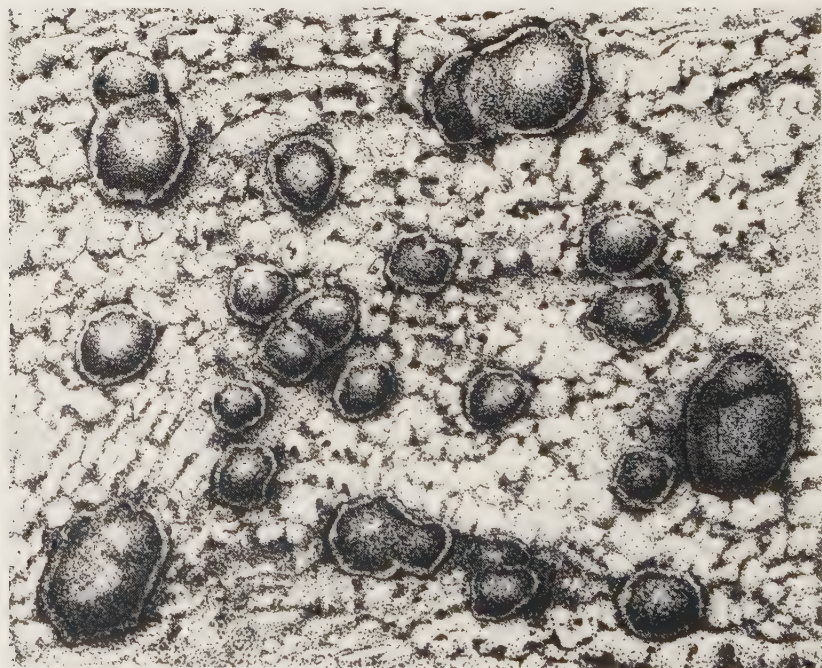
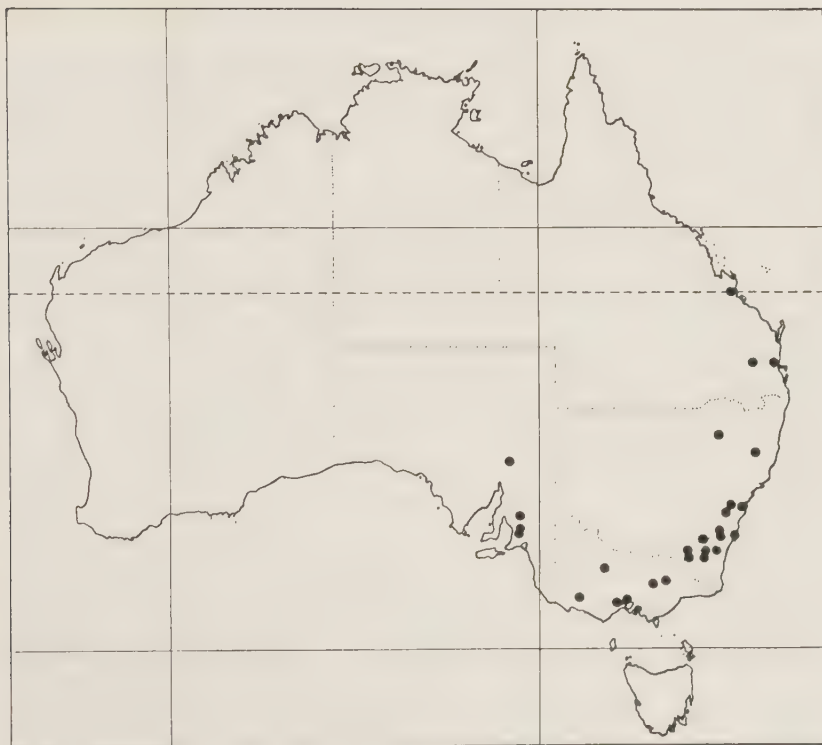


Fig. 5. *Carbonea montevidensis*. (GR 3949, M) Scale = 1 mm.



Map 5. Distribution of *Carbonea montevidensis* in continental Australia

NOTES:

C. montevidensis is characterized by a yellow-brown hypothecium, a green epihymenium, large spores and the content of 2'-O-methylperlatolic acid along with atranorin. The inner pigmentation resembles that of *Lecidella sublapicida*, which, however, differs chemically and by its asci. South African specimens of *C. montevidensis* contain only traces of 2'-O-methylperlatolic acid, but show no anatomical differences.

SPECIMENS EXAMINED:

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1000 m, 8.iv.1986, leg. G.Rambold 5543 (M); -- Springton, [34°13'S, 139°05'E], 27.xii.1973, leg. J.A.Elix 197 (ANUC); -- Guthries Steep Gully, 9 km E of Springton, 34°42'S, 139°04'E, 400 m, 12.viii.1981, leg. M.& H.Mayrhofer 2795 (GZU); -- Western slopes of Mt Crawford, Mt Lofty Ranges, 2.ix.1977, leg. J.A.Elix 3809 (MEL 1024408); -- 13.5 km N of Callington, Mt Lofty Ranges, [35°00'S, 139°E], 30.x.1981, leg. J.A.Elix 9440 (ANUC); --

Summit of Mt Barker, 32 km SE of Adelaide, 35°04'S, 138°55'E, 11.viii.1981, leg. M.& H.Mayrhofer 2804 (GZU).

Queensland: Thursday Island, [10°35'S, 142°13'E], [no date], leg. Ch. Knight (?) (S) - [locality probably not correct, see p. 319]; -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, leg. G.Rambold 4433, 4442, 4443 (M); -- Bunya Mountains, about 56 km NE of Dalby, NE of the J.S. Fisher Lookout, 26°53'S, 151°37'E, c. 1050 m, 3.ix.1986, leg. J.Hafellner 15491 (hb. Hafellner); -- Glasshouse Mtns, about 3 km S of Crookneck Mtn (Coonowrin), 26°57'S, 152°56'E, c. 100 m, 26.vii.1986, leg. J.Hafellner 15799 (hb. Hafellner).

New South Wales: Mt Kaputar National Park, Mt Ningadhun, 30°17'S, 150°04'E, 1100 m, 5.iv.1987, leg. P.Merrottsy 358, 381 (BRIU); -- Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4280, 4282, 4294, 4310 (M); -- Great Dividing Range, S of Hartley, SW of Katoomba, 33°15'S, 150°10'E, c. 850 m, 30.ix.1981, leg. M.& H.Mayrhofer 3393 (GZU); -- Blue Mountains, Springwood, Martins Lookout to Glenbrook Creek, 33°43'S, 150°33'E, on exposed sandstone rocks, 31.i.1986, leg. G.Rambold 4102 (M); -- Sydney, Mossman Bay, [33°53'S, 151°13'E], ix.1897, leg. F.R.M.Wilson (NSW 155742); -- Wanganderry Tableland, Lake Burangorang near Wollondilly River E of Byrnes Bay, SSW of "The Oaks", 34°12'S, 150°22'E, 3.x.1981, leg. H.Mayrhofer 3441 (GZU); -- Bungonia Lookdown, rim of Shoalhaven River, 7 mi E of Bungonia, [34°52'S, 150°E], 10.iv.1968, leg. W.A.Weber & D.McVean (COLO L-48900); -- Morton National Park, 8 km E of Nerriga, 35°05'S, 150°08'E, boulders in open *Eucalyptus* forest, 750 m, 23.i.1986, leg. G.Rambold 3899 (M); -- Merricumbene Fire Trail, 14 km SW of Araluen, 35°44'S, 149°53'E, 16.xi.1978, leg. H.Streimann 7311A (CBG, H); -- Tinderry Mountains, 10 km ESE of Michelago, 35°45'S, 148°18'E, 1250 m, 15.xi.1981, leg. H.Streimann 15927d-j (M); -- 17 km ESE of Michelago, Michelago - Jingera Track, 35°45'S, 149°21'E, dry sclerophyll forest on gentle slope, 970 m, 26.i.1986, leg. G.Rambold 3949, 3950 (M); -- Mt Jagungal, [36°09'S, 148°23'E], c. 6700 ft, 16.iii.1967, leg. R.Filson 10195 (MEL); -- 10 km E of Cooma along Numeralla road, [36°12'S, 149°15'E], 910 m, 9.i.1976, leg. J.A.Elix 1525 (ANUC); -- Cooma, 1 km NNW of town, 36°13'S, 149°08'E, low outcrops on slope, in open low *Eucalyptus* woodland beside road to Rosedale, 850 m, 19.i.1986, leg. G.Rambold 3674, 3676, 3679 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G.Rambold 3660, 3665 (M); -- Manly, 1.ix.1897, [no collector] (NSW 155785).

A.C.T.: Jervis Bay Territory, Moes Rock near Cape St George, 35°09'S, 150°46'E, coastal rocks, 0 m, 23.i.1986, leg. G.Rambold 3860 (M); -- Mt Ainslie, Canberra, [35°15'S, 149°10'E], 2000 ft, 30.ix.1967, leg. W.A.Weber & D.McVean (COLO L-47333); -- Mt Ainslie, Canberra, [35°15'S, 149°10'E], 30.ix.1967, leg. W.A.Weber (COLO L-47283).

Victoria: Mt Karong, 10 mi ESE of Wedderburn, [36°28'S, 143°45'E], 31.x.1964, leg. R.Filson 6604 (MEL); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3069, 3074 (M); -- Dunkeld, [37°39'S, 142°21'E], 12.xi.1896, leg. F.R.M.Wilson (MEL 6861); -- Yalla-y-poorra, 1895, leg. F.R.M.Wilson (COLO ex G); -- Rowsley, [37°43'S, 144°25'E], 27.xii.1901, leg. R.A.Bastow (MEL 6862, MEL 1031107); -- Yarra Bend, 6.viii.1886, leg. F.R.M.Wilson (NSW 155853); -- Kew, Yarra Boulevard, below Kew Mental Asylum, 37°48'S, 145°01'E, 40 m, 16.iv.1986, leg. G.Rambold 5599, 5600 (M); -- Kew, 37°48'S, 145°01'E, 1885, leg. F.R.M.Wilson (MEL 6860); -- Kew, [37°48'S, 145°01'E], 11.vii.1887, leg. F.R.M.Wilson (NSW 24686, 155859); -- Kew, 6.viii.1885, leg. F.R.M.Wilson (NSW 155789); -- Kew, 29.iii.1886, leg. F.R.M.Wilson (NSW 155790, 155850); -- Kew, 28.xi.1887, leg. F.R.M.Wilson (NSW 155860); -- Little River, [37°58'S, 144°30'E], iv.1887, leg. F.R.M.Wilson (NSW 155851, 155852); -- Little River, [no date], leg. F.R.M.Wilson (NSW 180250); -- Glenmaggie, [no date], leg. F.R.M.Wilson (NSW 155900b); -- Merri Creek, Northcote, 2.xii.1899, leg. R.A.Bastow (MEL 6863); -- Greengrove, iii.1897, leg. F.R.M.Wilson (NSW 155861).

***Carbonea vorticosa* (Flk.) Hertel**

HERTEL, Mitt. Bot. Staatssamml. München 19: 442 (1983); Beih. Nova Hedwigia 79: 444 - 445 (1984); Mitt. Bot. Staatssamml. München 21: 306 - 308 (1985).

≡ *Lecidea sabuletorum* δ (L.) *vorticosa* Flk., Ges. Naturf. Freunde Berlin Mag. 2: 311 (1808).

≡ *Lecidea vorticosa* (Flk.) Koerb., Syst. Lich. Germaniae: 251-252 (1855); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 717 - 718 no. 6850 (1925); 8: 363 (1932); ANDERSON, Genus *Lecidea* Rocky Mtns Nat. Park: 95 - 97 (1964); HERTEL, Beih. Nova Hedwigia 24: 104 - 107 (1967); Herzogia 2: 53 (1970); Herzogia 2: 252 (1971); Willdenowia 6: 246 - 247 (1971); Mitt. Bot. Staatssamml. München 12: 471 (1976); Khumbu Himal 3 (6): 316 - 317 (1977); Mitt. Bot. Staatssamml. München 19: 179 - 180 (1981).

Type: GERMANY: "Auf etwas glatten Steinen auf dem Harze, im Thüringischen, bey Berlin u.s.w." (vide protologue in FLÖRKE 1808 !) - [n.v.].

DESCRIPTION:

Thallus: cryptothalline to verrucose, up to 20 mm diam., up to 0.4 mm thick.

AREOLES: irregularly shaped, whitish, more or less plane, with rough surface, up to 0.5 mm, max. 0.9 mm diam. Cortex: upper cell layer not pigmented; epinecral layer not observed. Medulla I -.

HYPOTHALLUS: not obvious.

Apothecia: irregularly roundish, auriculate, crowded, 50 - 65/cm², sessile, constricted at the base, c. 0.5 - 0.8 mm, max. 1 - 1.2 mm diam. Disc plane to subconvex, black, nitid, epruinose. Margin distinct and persistent, black, nitid.

EXCIPULUM: max. 50 - 100 µm, lateral of hymenium 35 - 50 µm thick. Ectal zone dark brown; pigmentation diffuse; hyphae 4 - 7 µm diam., with lumina of 1.5 - 2 µm. Inner zone dark brown; hyphae parallel radiate, 4.5 - 7 µm diam., with lumina of 1 - 2 µm.

HYPOTHECIUM: dark brown, 50 - 100 µm thick; hyphae 4 - 5 (- 8) µm diam.; subhymenial layer colourless to greenish, c. 10 - 30 µm thick.

HYMENIUM: 40 - 55 µm tall, colourless to pale green. I+ blue, Iconc. ± blue. Epihymenium blue-green, 15 - 20 µm tall. Paraphyses mostly branched and anastomosing, 1.5 - 1.8 µm, apices c. 2 - 2.5 µm thick. Asci c. 32 - 45 x 8.5 - 9 µm; tholus max. 7 - 9 µm, min. 2 - 4 µm thick; masse axiale 3 - 3.5 µm; amyloid zone above masse axiale not obvious; outer amyloid wall layer c. 0.1 µm thick, I-, Iconc. -; non-amyloid wall layer c. 0.1 µm thick. Spores ellipsoid, non- to (very rarely) 1-septate, 8 - 13 x 3.5 - 5 µm.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.



Map 6. Distribution of *Carbonea vorticosa* in continental Australia

One chemotype observed, lacking lichen substances (1 specimen examined).

DISTRIBUTION:

Bipolar. New to Australia! *C. vorticosa* is an alpine species, which occurs in the Arctic region, the European Alps, the Himalayas, Japan and the Andes (Equador) (HERTEL 1977: 317). As substrate it prefers small siliceous stones, scattered on ground in exposed positions. The species belongs to a group of lichens growing at the highest altitudes. In the Himalayas it has been collected at 7400 m (HERTEL in press). Southern Hemisphere records are from the Andes, the Subantarctic and Antarctic Islands and New Zealand (HERTEL 1971, 1984, 1985). In continental Australia the species is confined to the alpine zone of the Snowy Mountains (map 6).

NOTES:

This species is easily recognizable by a dark brown hypothallus, a black-brown excipulum, a pale green hymenium and rather small, oblong-ellipsoid spores. *Carbonea montevidensis*, the only other representative of this genus in Australia, is restricted to lower altitudes and has a yellow-brown to pale brown hypothecium and larger spores.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3756 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3507 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31693 (M).

Clauzadeana Roux

ROUX, Bull. Soc. Linn. Provence 35: 99 - 101 (1983).

Typus generis: *Clauzadeana instratula* (Nyl.) Roux - (holotype)
[= *Clauzadeana macula* (Th.Tayl.) Coppins & Rambold].

The monotypic genus has a quite isolated position within the Lecanoraceae. It is characterized by small, immersed apothecia, an excipulum which contains algae, highly anastomosing paraphyses and a dark brown medulla.

Clauzadeana macula (Th.Tayl.) Coppins & Rambold **comb. nov.**

= *Lecidea macula* Tayl. in Mackay, Fl. Hib. 2: 115 (1836); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 633 no. 6553 (1925); 8: 349 (1932).

Type: IRELAND: Co. Kerry, Dunkerron, [no date], (?) leg. Th.Taylor (BM, holotype, BM ex K, isotype) - [fide COPPINS (in litt.)].

= *Lecidea perustula* Nyl.

NYLANDER, Flora 62: 361 (1879); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 633 (1925) - sub *L. macula*.

Type: IRELAND: Co. Galway, "very summit of the Doughruagh, Connemara, alt. 1800 ft, very scarce, 1875 ", leg. C. Larbalestier (BM, isotype); "near summit of Doughruagh Mt., Sept. 1875", leg. C.Larbalestier (BM ex K, isotype) - [fide COPPINS (in litt.)].

- = *Lecidea instratula* Nyl. **syn. nov.**
 NYLANDER, Flora 61: 242 (1878); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2, 18: 34 - 35 (1982).
- = *Lecidea fuscoatra* var. *instratula* (Nyl.) Boist., Nouv. Flore Lich. 2: 217 (1903) [n.v.].
- = *Clauzadeana instratula* (Nyl.) Roux, Bull. Soc. Linn. Provence 35: 99 - 102 (1983); CLAUZADE & ROUX, Bull. Soc. Centre-Ouest, N.S., Numéro Spécial, 7: 337 (1985); HERTEL & RAMBOLD, Mitt. Bot. Staatssamml. München 23: 380 (1987).
- Type: FRANCE: "Mont-Dore, la Bourboule", [no date], leg. E.Lamy 1269 (H-Nyl. 15329b, holotype, M!, isotype (?)) - [containing unknown substance CM-1].
- = *Aspicilia morioides* Blomb. ex Arnold
 ARNOLD, Lich. Exs. 904 (1881) - nomen nudum!; Verh. K. K. Zool.-Bot. Ges. Wien 37: 93 (1887) - (cum descr.).
- = *Lecanora morioides* (Arnold) Blomb., Bot. Not.: 96 - 97 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 5: 333 no. 10041 (1928); POELT, Mitt. Bot. Staatssamml. München 1: 325 (1953); ANDERSON, Bryologist 62: 249 (1962).
- Type: ITALY: "An Melaphyrblöcken eines Felsengerölles ausserhalb Predazzo am Wege zum Reiterjoch", 7.viii.1884, leg. F.Arnold (ARNOLD, Lich. Exs. 1044, M!, lectotype - designated in HERTEL & RAMBOLD 1987: 390). - [containing unknown substance CM-1].

DESCRIPTION:

Thallus: areolate, up to 35 - 50 mm diam., 0.2 - 0.25 mm thick.

AREOLES: roundish to angular, brown to dark brown, plane, with smooth surface, c. 0.2 - 0.3 mm, max. 0.3 - 0.5 mm diam. Cortex 25 - 30 µm thick; upper cell layer brown pigmented; hyphae c. 3 - 3.5 µm diam.; epinecral layer 15 - 25 µm thick. Algal layer c. 65 µm thick; algal cells c. 11 µm, max. 11 - 14 µm diam. Medulla I -; hyphae 5 - 7 µm thick.

HYPOTHALLUS: black, obvious at the thallus margin and between the areoles.

Apothecia: roundish, dispersed, 150 and more/cm², immersed, c. 0.15 - 0.2 mm, max. 0.15 - 0.2 mm diam. Disc plane, black, matt, epruinose. Margin not obvious.

EXCIPULUM: max. 90 µm, reduced, thalline zone lateral of hymenium up to c. 90 broad. Ectal zone greyish-brown; pigmented zone up to 25 µm tall; hyphae c. 5 µm diam., with lumina of c. 2 µm. Inner zone colourless, reduced; more or less medullar; hyphae c. 3.5 µm diam., with lumina of c. 1.5 µm. Medullary zone mostly with algal cells.

HYPOTHECIUM: colourless; hyphae c. 3 µm diam.; subhymenial layer colourless.

HYMENIUM: c. 40 µm tall, colourless, I-, Iconc. - . Epihymenium dark grey-green, 7 - 10 µm tall. Paraphyses often branched and anastomosing, c. 2 µm, apices (2.5 -) 3 - 4 µm thick. Asci c. 30 - 40 x 10

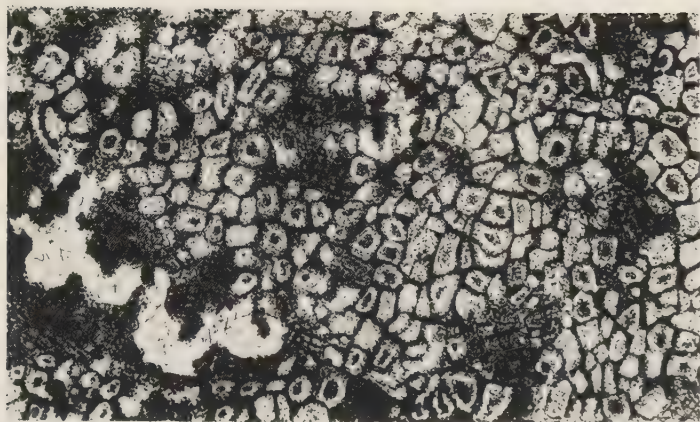


Fig. 6. *Clauzadeana macula*. (HH 31526, M) Scale = 1 mm.

- 11 μ m; tholus max. c. 9 μ m, min. 3 - 8 μ m thick; amyloid zone above masse axiale not obvious; outer amyloid wall layer c. 0.5 μ m thick, I+ red-brown, I conc. + red; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 8 - 12 x 4 - 5 μ m.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, P-, C- ; medulla K-, P-, C-.

One chemotype observed, containing unknown substance CM-1 (6 specimens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! This species was hitherto known from North America (Colorado) (ANDERSON 1962), Europe (POELT 1953: 325) and Japan (INOUE 1982). In Australia, it has been found in mountainous to alpine regions of W.A., S.A., N.S.W., A.C.T. and Vic. (map 7), growing on siliceous rocks.

NOTES:

This inconspicuous and mostly overlooked species is well characterized by its small immersed apothecia, a colourless hypothecium and a low hymenium. The dark brown pigmentation of the medullar hyphae, a feature which can also be observed e.g. in *Rimularia* (Rimulariaceae) or in *Orphniospora* (Fuscideaceae), is rather conspicuous.



Map 7. Distribution of *Clauzadeana macula* in continental Australia

SPECIMENS EXAMINED:

Western Australia: Stirling Range National Park, Bluff Knoll, 34°23'S, 118°15'E, exposed sandstone outcrops on peak SW of summit, c. 1000 m, 3.iv.1986, leg. G.Rambold 5393, 5413 (M).

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G. Rambold 5479, 5480 (M).

New South Wales: Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3934 (M); -- Kosciuszko National Park, summit of Mt Kosciuszko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31671b (M).

A.C.T.: Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4042 (M).

Victoria: Great Dividing Range, Mt. Wombargo near Rocky Plains, 36°56'S, 148°12'E, c. 1400 m, 27.ii.1985, leg. H.Hertel 31526 (M).

Lecanora Ach. in Luyken

LUYKEN, Tent. Hist. Lich.: 90 (1809) [n.v.].

Lecanora (Ach.) emend. Massal., Ricerche Lich.: 1 (1852).

Typus generis: *Lecanora subfusca* (L.) Ach. - (lectotype, designated in CHOISY 1929: 522).

= *Diomedella* Hertel **syn. nov.**

HERTEL, Beih. Nova Hedwigia 79: 445 (1984).

Typus generis: *D. disjungenda* (Cromb.) Hertel - (holotype).

Although several entities meanwhile are excluded from *Lecanora* sensu ZAHLBRUCKNER, this genus still seems inhomogenous. In the synonymy of *Lecanora* a number of suitable names for potential genera like *Myriolectis* Clements, *Protoparmeliopsis* Choisy, *Straminella* Choisy, or *Zeora* Fr. exists. The centre of *Lecanora* is represented by the "*Lecanora subfusca* -group", which was treated for various regions by MAGNUSSON (1932), by KOFLER (1956) and by BRODO (1984). Other natural units are the "*Lecanora pallida* -group" (IMSHAUG & BRODO 1966), and the "*Lecanora marginata* -group", the latter including leci-deoid species. Exact delimitations between these groups have not yet been found and have to be worked out in further studies. The four species treated here, are regarded as members of the following units: *L. impressa* of the *L. subfusca* -group ("*Lecanora* s.str."), *L. demersa*, *L. marginata* and *L. oreinoides* of the *L. marginata* -group ("*Zeora*" ?), and *L. polytropa* of the *L. varia* -group ("*Straminella* ").

The close relationship between *Diomedella* and *Lecanora* has been discussed by HERTEL (1984). Immersed apothecia have been independently developed in the various groups of *Lecanora* s.l. and cannot be accepted as a main generic character. For this reason, *Diomedella* is not accepted as a separate genus. HERTEL regarded *Heppsora* as possibly being closely related to *Diomedella*. *Heppsora*, however, is now recognized as a synonym of *Tephromela*, which is distinguished from *Lecanora* (incl. *Diomedella*), e.g. by a different ascus type, different paraphyses and conidia (HERTEL & RAMBOLD 1985).

Table 6. The main characters of the saxicolous species of *Carbonea*, *Lecanora* and *Lecidella* occurring in continental Australia:

1.) Adnation of apothecia; 2.) margination of apothecia; 3.) average breadth of spores [μm]; 4.) colour of the hypothecium 5.) height of epinecral layer [μm]; 6.) length of conidia [μm]; 7.) development and colour of hypothallus; 8.) chemistry (major substances).

[atr = atranorin; biat = biatorine; bl = black; br = brown; cl = colourless; confl = confluent acid; d = dark; dipl = diploicin; f.a. = fatty acid; gre = grey; i = immersed; lecan = lecanorine; lecid = lecidine; 2'-mpa = 2'-O-methylperlatolic acid; or = orange; se = sessile; si = subimmersed; usn = usnic acid; vic = vicanicin; xan = xanthonic; zeo = zeorin].

	Apoth. adn.	Apoth. marg.	Spore br.	Hypoth. colour	Epinecral layer	Conidia length	Hyp. th.	Chemistry
<i>Carbonea</i>								
<i>C. montevid.</i>	se	lecid	6 - 7.5	or.br	-	10-20	-	atr, 2'-mpa
<i>C. vorticosa</i>	se	lecid	3.5 - 5	d.br	-	?	-	-
<i>Lecanora</i>								
<i>L. demersa</i>	sl/i	±lecid	6 - 7	cl	+	25-35	bl	atr, f.a.
<i>L. impressa</i>	l/sl	-/lecan	4.5 - 5	cl	-	17-22	gre	atr, zeo, xan
<i>L. marginata</i>	se	lecid	4.5 - 6	cl	+	11-24	bl	atr usn
<i>L. oreinoides</i>	i	-	4 - 6	cl	-	8-15	bl	atr, confl
<i>L. polytropa</i>	se	blat	4 - 5.5	cl	-	?	-	usn, zeo, f.a.
<i>Lecidella</i>								
<i>buelliastrum</i>	se	lecid	5 - 6.5	cl/or.br	-	13-25	-	atr, dipl, xan
<i>enteroleucella</i>	se	lecid	4.5 - 6	cl	±	15-25	-	atr, xan
<i>stigmatea</i>	se	lecid	6 - 9	cl	±	20-30	-	atr, zeo /-
<i>sublapicida</i>	se	lecid	5 - 8	or.br	-	?	-	vic, xan

***Lecanora demersa* (Kremp.) Hertel & Rambold comb. nov.**

= *Lecidea demersa* Kremp., Verh. K. K. Zool.-Bot. Ges. Wien 26: 455 (1876); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 561 no. 6398 (1925); GALLOWAY, Fl. New Zeal. Lichens: 230 (1985).

= *Diomedella demersa* (Kremp.) Hertel, Beih. Nova Hedwigia 79: 445 (1984).

Type: NEW ZEALAND: [probably near Wellington, no date], leg. Ch. Knight (M!, holotype; M, isotype) - [containing atranorin, unknown fatty acid (roccellic acid ?)].

DESCRIPTION:

Thallus: areolate, up to 80 mm diam., 0.5 - 1.0 mm thick.

AREOLES: angular to irregularly undulate, white, plane, with smooth to rough or wrinkled surface, c. 0.7 - 1.0 mm, max. 1.5 - 2.0 mm diam. Cortex 20 - 25 μ m thick; upper cell layer not pigmented; hyphae c. 4 μ m diam.; epinecral layer up to 25 μ m thick. Algal layer c. 100 - 150 μ m thick; algal cells c. 8 - 10 μ m, max. 13 - 16 μ m diam. Medulla I -; hyphae 3 - 5 μ m thick.

HYPOTHALLUS: black, mostly well developed, obvious at the thallus margin, more or less effigurate, occasionally also visible between the areoles.

Apothecia: irregularly roundish, dispersed, up to 45/cm², subimmersed to immersed, c. 0.7 - 1.3 mm, max. 1.2 - 1.5 mm diam. Disc subconvex, black, matt to subnitid, epruinose. Margin at first distinct but thin or not developed, later vanishing, black, matt.

EXCIPULUM: reduced or developed and max. up to 100 μ m, lateral of hymenium up to 100 μ m thick. Ectal zone green-black; pigmented zone diffuse; hyphae 3.5 - 5 μ m diam., with lumina of 1 - 2 μ m. Inner zone colourless; hyphae 3.5 - 4 μ m diam., with lumina of 1.2 - 1.5 μ m. Medullary zone not developed.

HYPOTHECIUM: colourless, hyphae 3 - 3.5 μ m diam.; subhymenial layer colourless.

HYMENIUM: 45 - 65 μ m tall, colourless, I $\pm$ blue, I_{conc.}-. Epihymenium green to dark green, 10 - 15 μ m tall. Paraphyses anastomosing and branched, c. 2 μ m, apical 3 - 4 μ m thick. Asci c. 45 - 50 x 10 - 15 μ m; tholus max. 7 - 9 μ m, min. 3 - 5 μ m thick; outer amyloid wall layer c. 0.3 μ m thick, I $\pm$ brownish, I_{conc.}+ brown; non-amyloid wall layer c. 0.5 μ m thick; masse axiale c. 2 μ m broad; amyloid zone above masse axiale not obvious. Spores ellipsoid, 9 - 9.4 - 10.3 - 12 x 6 - 6.5 - 7 μ m.

Pycnidia: immersed. Conidia filiform, curved, 25 - 35 x 0.8 - 1 μ m.

CHEMISTRY:

Cortex K + yellow, P $\pm$ yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing atranorin and unknown fatty acid (roccellic acid ?). (2 specimens examined).

DISTRIBUTION:

Australasian. New to Australia! This species was hitherto only known from New Zealand. Within Australia, it has been collected in the Kosciusko National Park and in the Brindabella Range on summit of Mt Aggie (A.C.T.), growing on siliceous rock (map 8).

NOTES:

L. demersa is well characterized by subimmersed to immersed, black apothecia and the presence of atranorin and a fatty acid. A black, mostly conspicuous hypothallus is developed at the thallus margin

and occasionally also between the areoles. A closely related species, *Lecanora disjungenda*¹⁾, contains zeorin along with atranorin.

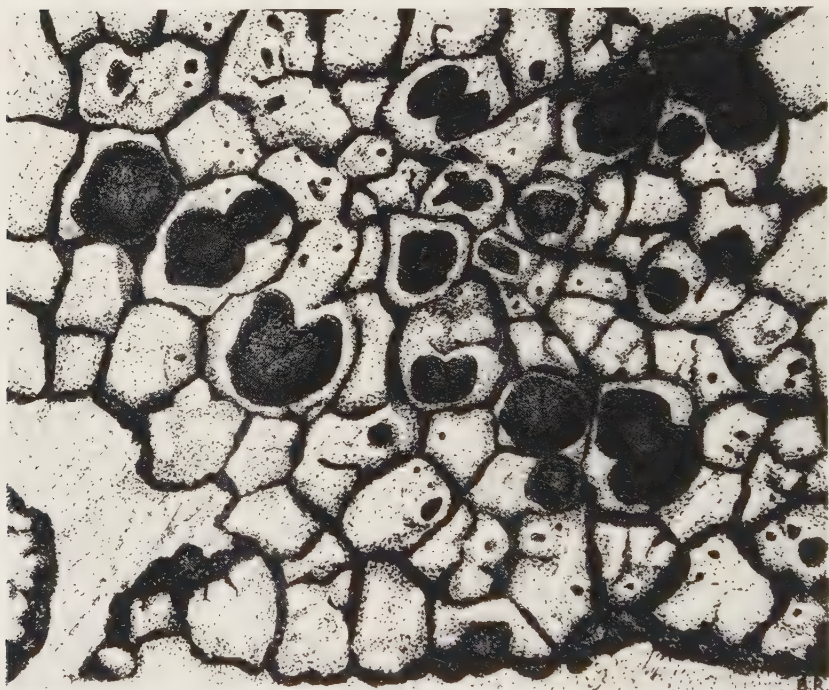


Fig. 7. *Lecanora demersa*. (GR 4043, M) Scale = 1 mm.

1) *Lecanora disjungenda* (Cromb.) Hertel & Rambold **comb. nov.** = *Lecidea disjungenda* Cromb., J. Bot. 15: 105 (1877); - *Aspicilla disjungenda* (Cromb.) Dodge, B.A.N.Z.A.R.E. Rep., Ser. B, 7: 167 (1948); - *Diomedella disjungenda* (Cromb.) Hertel, Beih. Nova Hedwigia 79: 446 (1984); - type: KERGUELES: Christmas Bay, H.N.Moseley (Challenger Expedition) (BM!), lectotype - designated in HERTEL 1984: 446) - [containing atranorin, zeorin].



Map 8. Distribution of *Lecanora demersa* in continental Australia

SPECIMENS EXAMINED:

N.S.W.: Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3481 (M).

A.C.T.: Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°48'E, 1480 - 1490 m, 19.x.1981, leg. V.Wirth 14067 (STU); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4017, 4043 (CBG, M).

Lecanora impressa (Kremp.) Zahlbr.

Zahlbruckner, Catal. Lich. Univ. 5: 319-320 no. 9996 (1928).

= *Lecidea impressa* Kremp., Flora 59: 318 (1876); Shirley in Bailey, Queensl. Dept. Agr. Bull. 9: 27 (1891).

Type: BRASILIA: Prov. Rio de Janeiro: "ad saxa silicea", [no date], leg. D.A. Glaziou (M!, holotype) - [containing atranorin, zeorin].

= *Lecidea leioplaca* Müll. Arg. **syn. nov.**

MÜLLER ARGOVENSIS, Flora 70: 61 (1887); Zahlbruckner, Catal. Lich. Univ. 3: 788 no. 7105 (1925); Shirley, Proc. Roy. Soc. Queensland 6 (2+3): 116 (1889); Weber & Wetmore, Beih. Nova Hedwigia 41: 53 (1972); Filson, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 122 (1986); Checklist Austr. Lich. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: Queensland: Rockhampton, [no date], leg. A. Thozet (G!, holotype; M!, isotype!) - [containing atranorin, zeorin].

= *Lecanora laevissima* Knight in Shirley **syn. nov.**

Shirley, Proc. Roy. Soc. Queensland 6 (4): 133 - 134 (1889); Zahlbruckner, Catal. Lich. Univ. 5: 480 no. 10394 (1928). Weber & Wetmore, Beih. Nova Hedwigia 41: 48 (1972); Filson, Checklist Austr. Lich. 1. ed.: 43 (1983); Checklist Austr. Lich. 2. ed.: 55 (1986); Austr. Fl. Fauna Ser. 4: 106 (1986); Checklist Austr. Lich. 3. ed.: 17, 99 (1988).

Type: AUSTRALIA: Queensland: Mt Perry, [no date], leg. J. Keys 989 (Shirley Herb. Book p. 19 no. 8) (BRI 354958!, holotype) - [containing atranorin, zeorin].

= *Lecidea wilsonii* Räs. **syn. nov.**

Räsänen, Ann. Soc. Zool. Bot. Fenn. Vanamo 3: 183 (1949); Lamb, Index Nom. Lich.: 390 (1963); Filson, Checklist Austr. Lich. 1. ed.: 51 (1983); Checklist Austr. Lich. 2. ed.: 65 (1986); Austr. Fl. Fauna Ser. 4: 132 (1986); Checklist Austr. Lich. 3. ed.: 20, 107 (1988).

Type: AUSTRALIA: Queensland: Korunda, Cavins (= Cairns? - vide Filson 1986), 1893, leg. F.R.M. Wilson (H!, holotype; H!, G! isotypes) - [containing atranorin, zeorin, chodatrin (traces ?)].

DESCRIPTION:

Thallus: areolate, up to 75 mm diam., 0.2 - 1.0 mm thick.

AREOLES: with undulate margins, creamy whitish to white, plane, with mostly smooth surface, c. 0.3 - 0.5 mm, max. 0.3 - 2.0 mm diam. Cortex 15 - 55 µm thick; upper cell layer colourless; hyphae c. 2.5 - 3.5 µm diam.; epinecral layer not developed. Algal layer c. 50 - 100 µm thick; algal cells c. 7 - 9 µm, max. 10 - 11 µm diam. Medulla 1± brown; hyphae 3 - 4.5 µm thick.

HYPOTHALLUS: whitish to greyish, obvious at the thallus margin or not developed.

Apothecia: round to irregularly roundish, dispersed to crowded, 100 - 400/cm², immersed, rarely subimmersed, c. 0.2 - 0.6 mm, max. 0.5 - 0.9 mm diam. Disc plane, pale brown to black-brown, matt, epruinose. Margin reduced or, if developed, thalline.

EXCIPULUM: thalline zone lateral of the hymenium up to 20 - 80 µm thick. Ectal zone colourless. Inner zone medullar, colourless; hyphae 2.5 - 4 µm diam., with lumina of 1 - 1.3 µm.

HYPOTHECIUM: colourless, hyphae 2.5 - 3.5 µm diam.; subhymenial layer colourless.

HYMENIUM: 45 - 65 µm tall, colourless, I± blue, I conc.-. Epihymenium pale brown to brown, 8 - 15 µm tall. Paraphyses more or less branched and anastomosing, 1.5 - 2 µm, apices 3 - 4 µm thick. Asci c. 35 - 55 x 9 - 12 µm; tholus max. 9 - 11 µm, min. 2 - 4 µm thick; amyloid zone above masse axiale not obvious, outer amyloid wall layer c. 0.2 µm thick, I-, I conc.± brownish; non-amyloid wall layer c. 0.2 µm thick. Spores ellipsoid, 8.5 - 12 (- 16) x 4.5 - 5 µm.

Pycnidia: immersed. Conidia filiform, curved, 17 - 22 x c. 0.8 µm.

CHEMISTRY:

Cortex K + yellow, P± yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

Several chemotypes observed, containing constantly atranorin (+ chloroatranorin) and zeorin along with chodatin and demethylchodatin, thiophanic acid (?) and unknown xanthones in various concentrations and combinations (40 specimens examined).

DISTRIBUTION:

Pantropical (?). This species is known from Brazil (type material of *L. impressa*) and Australia. *L. impressa* is widely distributed in Qld and occurs locally in N.T. (map 9). It can be found in (sub-) tropical forests (e.g. in vineforests or monsoon forests), growing mostly on siliceous rocks close to the water.

NOTES:

L. impressa is characterized by completely immersed apothecia, a brownish-pigmented epihymenium and the presence of zeorin and atranorin, often along with chodatin, demethylchodatin and several xanthones in various combinations and concentrations. *L. impressa* is rather uniform concerning anatomy and distribution. The species resembles *Lecanora oreinoides*, which has a greenish epihymenium, constantly contains atranorin and confluent acid, and has a more southern distribution within Australia.

EXSICCATA EXAMINED (Australian material):

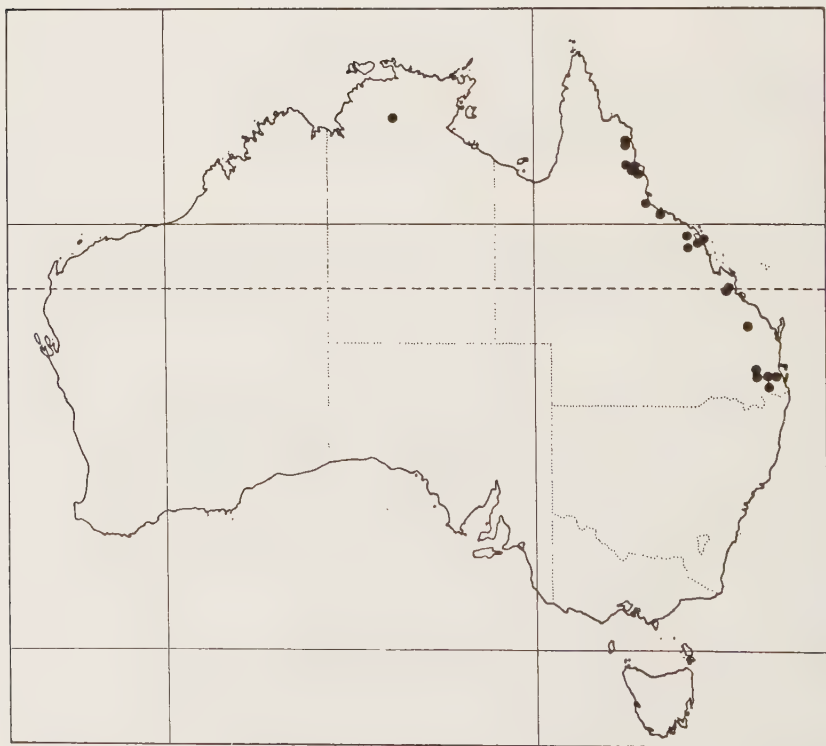
HERTEL, Lecideac. Exs. no. 184 ("*Lecanora impressa*"). (M)

SPECIMENS EXAMINED:

Northern Territory: 25 km NE of Katherine, Butterfly Gorge, 14°19'S, 132°27'E, sandstone boulders in monsoon forest, 200 m, 21.iii.1986, leg. G. Rambold 5107, 5108 (M).

Queensland: Grassy Hill, N of Cooktown, [15°28'S, 145°15'E], 23.iv.1973,

leg. D.Jones (MEL 1020225); -- Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. H.Streimann 30717 (CBG); -- Near summit of Mt Leswell, 32 km S of Cooktown, 15°46'S, 145°15'E, 440 m, 5.vii.1984, leg. H.Streimann 30944 (CBG); -- Stoney Creek, 4 km NW of Mt Molloy, 16°40'S, 145°18'E, 3.vii.1984, leg. H.Streimann 30691 (CBG 8409196); -- "Korunda, Cavins", [16°49'S, 145°38'E], 1893, leg. F.R.M.Wilson (type of *Lecidea wilsonii* Räs.) (H, G); -- Barron River at Korunda, [16°50'S, 145°38'E], vii.1893, leg. F.R.M.Wilson (NSW 155870); -- Korunda Falls, [16°50'S, 145°38'E], [no date], leg. F.R.M. Wilson (NSW 155871); -- Cairns, Barron Falls, [16°50'S, 145°38'E], 1893, leg. F.R.M.Wilson (MEL 7001); -- Davies Creek National Park, Davies Creek Falls, 17°00'S, 145°35'E, boulders in and beside stream, in open woodland, c. 500 m, 4.iii.1986, leg. G.Rambold 4949 (M); -- Fishery Falls, 13 km SE of Gordonvale, 17°11'S, 145°52'E, basalt boulders beside stream, in tropical rainforest, 80 m, 3.iii.1986, leg. G.Rambold 4926, 4930 (M); -- Crystal Creek National Park, Little Crystal Creek, 19°01'S, 146°16'E, rocky outcrops and boulders beside falls, c. 365 m, 25.ii.1986, leg. G.Rambold 4805, 4807, 4808 (M); -- Mt Elliot National Park, c. 30 km SE of Townsville, near Alligator Creek Falls, 19°28'S, 147°00'E, boulders in open forest, 220 m, 24.ii.1986, leg. G.Rambold 4715, 4725, 4734, 4744, 4745, 4749 (M); 4720 (BRI, M); -- Andromache River, 25



Map 9. Distribution of *Lecanora impressa* in continental Australia

km SW of Proserpine, 20°35'S, 148°26'E, 80 m, 2.vii.1986, leg. J.A.Elix 21181 (ANUC); -- Brampton Island, 20°49'S, 149°17'E, 8.viii.1974, leg. J.M.Gilbert (HO 63769); -- Cape Hillsborough National Park, 30 km N of Mackay, Hidden Valley, 20°55'S, 149°03'E, conglomerate rocks in rainforest with *Ptychosperma elegans*, 10 m, 21.ii.1986, leg. G.Rambold 4656, 4660, 4662 (M); -- Eungella National Park, NW of Mackay, track along Broken River, 21°10'S, 148°29'E, subtropical rainforest between Broken River Camping Area and Platypus Pool, 680 m, 18.ii.1986, leg. G.Rambold 4566, 4568, 4571 (M); -- Jim Crow Mtn, 25 km NE of Rockhampton, 23°13'S, 150°38'E, S exposed, partially shaded basaltic rock walls, 200 - 230 m, 14.ii.1986, leg. G.Rambold 4476, 4484, 4485, 4486, 4488 (M); -- 4492 (Hertel, Lecideac. Exs. no. 184); -- Rockhampton, [23°22'S, 150°32'E], [no date], leg. A.Thozet (type of *Lecidea leioplaca* Müll.Arg., G); -- Mt Perry, [25°11'S, 151°39'E], [no date], leg. J. Keys 989 (type of *Lecanora laevissima* Knight, BRI 354958); -- Perserverance Dam, W of dam wall, 27°17'S, 152°08'E, 500 m, 4.ix.1986, leg. R.W.Rogers 8384 (BRIU); -- Brisbane, Hillend, [27°28'S, 153°01'E], [no date], leg. F.R.M.Wilson (NSW 180239); -- Hillend, [27°28'S, 153°01'E], 1897, leg. F.R.M.Wilson (NSW 155795); -- Lowood, [27°28'S, 152°35'E], [no date], leg. F.R.M.Wilson (NSW 155872); -- Helidon, [27°33'S, 152°08'E], [no date], leg. J.Shirley (?) (BRI 354959); -- Mt French, Mt French National Park, near Boonah, 27°59'S, 152°37'E, 200 m, 10.iv.1985, leg. R.W.Rogers 7688 (BRIU).

***Lecanora marginata* (Schaer.) Hertel & Rambold**

HERTEL & RAMBOLD, Bot. Jahrb. Syst. 107: 494 (1985).

= *Lecidea marginata* Schaer., Naturw. Anzeiger Allgem. Schweiz. Ges. Naturw. 2: 10 (1818); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 634 (1925); 8: 349, 374 (1932); LEUCKERT & HERTEL, Nova Hedwigia 14: 292 - 293 (1967); HERTEL, Beih. Nova Hedwigia 24: 118 - 123 (1967); Khumbu Himal 6 (3): 295 - 297 (1977).

= *Lecidella marginata* (Schaer.) Koerb., Syst. Lich. Germaniae: 241 (1855).

= *Lecidea elata* β . *marginata* (Schaer.) Massal., Ricerche Lich.: 77 (1852).

Type: [n.v.] - SWITZERLAND: "Susten", [no date], (?) leg. L.M. Schaerer (SCHAERER, Lich. Helv. Exs. no. 189, M, "topotype") - [containing atranorin, usnic acid].

DESCRIPTION:

Thallus: areolate, up to 90 mm diam., 0.5 - 1.2 mm thick.

AREOLES: with more or less undulate margins, pale yellow, plane, with smooth surface, c. 0.6 - 0.8 mm, max. 1.3 - 1.8 mm diam. Cortex up to 40 μ m thick; upper cell layer colourless to greyish pigmented; hyphae c. 4 μ m diam.; epinecral layer up to 10 μ m thick. Algal layer c. 150 μ m thick; algal cells c. 10 - 12 μ m, max. 15 μ m diam. Medulla I $\pm$ brownish; hyphae c. 4 μ m thick.

HYPOTHALLUS: black, obvious at the thallus margin.

Apothecia: irregularly roundish to auriculate, mostly crowded, 25 - 40/cm², more or less constricted at the base, c. 0.9 - 1.0 mm, max. 1.4 - 1.6 mm diam. Disc plane to convex, black, matt, more or less

pruinose. Margin at first distinct, later mostly vanishing, black, matt. EXCIPULUM: max. 70 - 150 μm , lateral of hymenium 30 - 80 μm thick. Ectal zone grey-green; pigmented zone 15 - 25 μm thick; hyphae c. 5 μm diam., with lumina of 1 - 1.2 μm . Inner zone colourless; hyphae parallel radiate, 5 - 6 μm diam., with lumina of 0.9 - 1.1 μm . Medullary zone more or less developed.

HYPOTHECIUM: colourless; hyphae 3 - 4 μm diam.; subhymenial layer colourless.

HYMENIUM: 45 - 60 μm tall, colourless, I $\pm$ blue, I conc. -. Epihymenium dark green to olivaceous, 8 - 12 μm tall. Paraphyses more or less branched, rarely anastomosing, 1.5 - 2 μm , apices 2.8 - 4 μm thick. Asci c. 45 - 50 x 10 - 11 μm ; tholus max. 8 - 10 μm , min. 3 - 5 μm thick; amyloid zone above masse axiale up to c. 1.2 μm thick or not obvious; outer amyloid wall layer 0.2 μm thick, I $\pm$ brown, I conc. + brown; non-amyloid wall layer 0.3 - 0.8 μm thick. Spores ellipsoid, 8 - 12 x 4.5 - 6 μm .

Pycnidia: immersed. Conidia filiform, curved, 11 - 24 x 1 - 1.8 μm . The conidiogenous cells are illustrated in HERTEL & RAMBOLD (1985: 489).

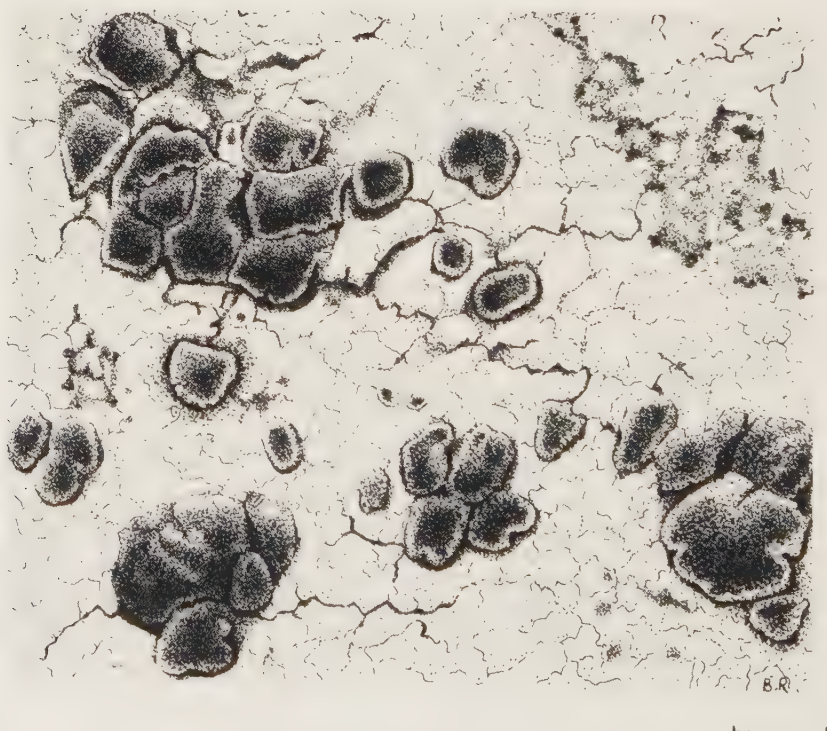


Fig. 8. *Lecanora marginata*. (MEL 1023687) Scale = 1 mm.

CHEMISTRY:

Cortex K + yellow, P± yellow, C-; medulla K-, P-, C-; excipulum K± yellow, P± yellow, C-.

One chemotype observed, containing atranorin and usnic acid (4 specimens examined).

DISTRIBUTION:

Bipolar. New for the Southern Hemisphere! In the Northern Hemisphere *L. marginata* is known from arctic and alpine habitats of North America and Eurasia (ANDERSON 1964, HERTEL 1967), growing on calcareous as well as on calciferous siliceous rocks. Within Australia, the species occurs in the alpine zone of N.S.W. and Vic. (map 10).



Map 10. Distribution of *Lecanora marginata* in continental Australia

NOTES:

L. marginata is characterized by the presence of atranorin and usnic acid, by a whitish to yellowish coloured thallus and black, more or less pruinose apothecia. A closely related species is *L. sulphurea* (Hoffm.) Ach., described from Europe, which contains usnic acid, atranorin, zeorin, gangaleoidin and α -collatolic acid in various combinations and concentrations. Other related species are *L. xantholeuca* (Müll.Arg.) Hertel, described from the Falkland Islands, and *L. avium* (Zahlbr.) Hertel, occurring in Chile. Both species also show pruinose apothecia discs, but according to HERTEL (1984: 475), contain atranorin, zeorin and unidentified substances. *L. subcoarctata*, which is known from New Zealand, is confined to coastal rocks and contains atranorin, zeorin, arthothelin and O-methylmonochlorlichexanthone.

SPECIMENS EXAMINED:

New South Wales: Mt Jagungal, [36°09'S, 148°23'E], c. 6700 ft, 16.iii.1967, leg. R.Filson 10195 (MEL).

Victoria: Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3069, 3074 (M); -- Mt Buller, [37°09'S, 146°26'E], 11.ii.1967, leg. R.Filson 9679 (MEL).

Lecanora oreinoides (Koerb.) Hertel & Rambold **comb. nov.**

= *Aspicilia oreinoides* Koerb., Abh. Schles. Ges. Vaterl. Cult., Abth. Naturwiss. 2: 32 (1862); FILSON, Austr. Fl. Fauna Ser. 4: 20 (1986).

= *Lecidea oreinoides* (Kremp.) Hochst. ex Nyl., Flora 47: 267 (1864) - comb. inval. (vide HERTEL 1973).

= *Lecidea lactea* f. *oreinoides* (Koerb.) Nyl., Flora 47: 267 (1864).

= *Lecidea pantherina* f. *oreinoides* (Koerb.) Zahlbr., Catal. Lich. Univ. 3: 650 (1925); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 125 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988).

= *Lecidea oreinodes* (sic!) (Koerb.) W.A.Weber & Hertel, Herzogia 2: 479, 493 - 494 (1973); Khumbu Himal 6 (3): 297 - 300 (1977); OSORIO, Com. Bot. Museo Hist. Nat. Montevideo 73 (4): 4 (1987).

Type: AUSTRALIA: "Ad saxa arenaria Novae Hollandiae", leg. F. Hofstetter 25 (L 910.134-2202!, lectotype - designated in HERTEL 1973: 493) - [not analyzed chemically].

= *Lecidea angolensis* Müll.Arg.

MÜLLER ARGOVIENSIS, Linnaea 63: 35 - 36 (1880); SHIRLEY in BAILEY, Queensl. Dept. Agric. Bull. 9: 27 (1891); MÜLLER ARGOVIENSIS, Hedwigia 30: 49 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 513 no. 6281 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); Checklist Austr. Lich. 2. ed.: 57 (1986); Checklist Austr. Lich. 3. ed.: 18, 101 (1988).

Type: ANGOLA: Pungo Andongo, 1880, leg. Soyaux (G!, isotype) - [not analyzed chemically].

= *Lecidea mundula* Müll.Arg. **syn. nov.**

MÜLLER ARGОВIENSIS, Flora 70: 336 (1887); ZAHLBUCKNER, Catal. Lich. Univ. 3: 639 no. 6579 (1925); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 124 (1986).

Type: AUSTRALIA: New South Wales: Walcha, Apsley River, 1884, leg. N.R.Crawford (Gl, holotype) - [containing atranorin, confluent acid, 2'-O-methylmicrophyllinic acid].

DESCRIPTION:

Thallus: areolate, up to 60 mm diam., 0.3 - 0.7 mm thick.

AREOLES: with undulate margins or angular, white, plane, with mostly smooth surface, c. 0.4 - 0.5 mm, max. 0.5 - 1.0 mm diam. Cortex 15 - 35 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer not developed. Algal layer c. 40 - 70 µm thick; algal cells c. 7 - 9 µm, max. 11 - 12 µm diam. Medulla I ± brown; hyphae 3 - 4 µm thick.

HYPOTHALLUS: black, obvious between the areoles and at the thallus margin or not developed.

Apothecia: round to roundish, dispersed to crowded, 200 - 350/cm², immersed, c. 0.25 - 0.4 mm, max. 0.3 - 0.6 mm diam. Disc plane, black, matt, epruinose. Margin reduced.

EXCIPULUM: reduced. Thalline zone lateral of the hymenium 60 - 120 µm thick. Ectal zone colourless to grey; pigmented zone c. 10 µm tall; hyphae c. 4 - 5 µm diam., with lumina of 1 - 2 µm. Inner zone medullar, colourless to grey; hyphae c. 3 µm diam., with lumina of 1 - 1.5 µm.

HYPOTHECIUM: colourless, hyphae 2 - 3 µm diam.; subhymenial layer colourless.

HYMENIUM: 40 - 60 µm tall, colourless, I+ blue, Iconc. ± blue. Epihymenium grey-green, 7 - 10 µm tall. Paraphyses occasionally branched, mostly not anastomosing, 1.5 - 2 µm, apices 2 - 4 µm thick. Asci c. 30 - 40 x 8 - 14 µm; tholus max. 8 - 10 µm, min. 3 - 5 µm thick; amyloid zone above masse axiale not obvious; outer amyloid wall layer 0.2 - 0.5 µm thick, I+ bluish, Iconc. ± brown; non-amyloid wall layer c. 0.2 µm thick. Spores ellipsoid, 7 - 11 (- 13) x 4 - 6 (- 6.5) µm.

Pycnidia: subimmersed. Conidia cylindrical, 8 - 15 x 0.8 - 1 µm. Conidiogenous cells like in *Lecanora* (HERTEL & RAMBOLD 1985: 489 fig. 7).

CHEMISTRY:

Cortex K + yellow, P ± yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing atranorin, confluent acid (22 specimens examined).

DISTRIBUTION:

L. oreinoides is widely distributed. According to HERTEL (1971, 1977), it is known from non-arid regions of North America (U.S.A.), Africa (Angola, Island of Rodriguez), Oceania (Hawaii), Asia (S. India, Burma,

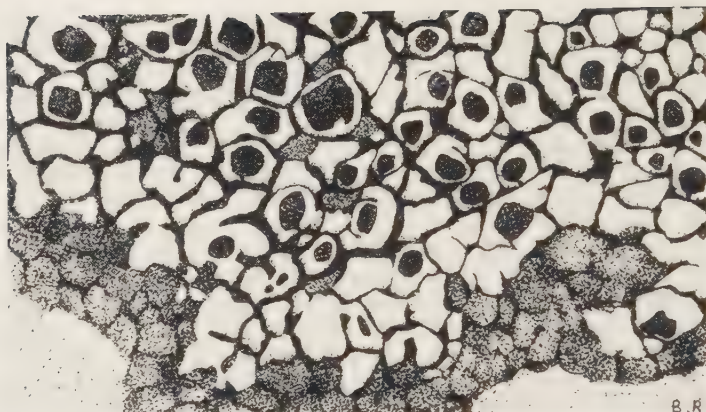


Fig. 9. *Lecanora oreinoides*. (RWR 7952, BRIU) Scale = 1 mm.

China, Japan) and Australia. Within continental Australia, it occurs from the northern part of Qld to N.S.W., A.C.T. and Vic (map 11), growing on siliceous rocks.

NOTES:

L. oreinoides is characterized by immersed apothecia, a colourless hypothecium, green epihymenium, and the presence of atranorin and confluent acid. It resembles *Lecanora impressa*, which also has immersed apothecia and a colourless hypothecium. The latter species is, however, distinguished by a brown epihymenium and a different chemistry. Within Australia *L. impressa* is restricted to the subtropical and tropical region, while *L. oreinoides* has its main distribution in southern Queensland and in N.S.W.

SPECIMENS EXAMINED:

Queensland: Grassy Hill, N of Cooktown, [15°28'S, 145°15'E], 23.iv.1973, leg. D.Jones (MEL 1020225); -- Bellenden Ker Expedition, [17°16'S, 145°51'E], vi.1889, leg. F.M.Bailey 603 (BRI 354945); -- Jim Crow Mtn, 25 km NE of Rockhampton, 23°13'S, 150°38'E, S exposed, partially shaded basaltic rock walls, 200 - 230 m, 14.ii.1986, leg. G.Rambold 4473 (M); -- Blackdown Tableland National Park, Rainbow Fall Lookout, 23°51'S, 149°06'E, outcrops of sandstone, c. 600 m, 14.ii.1986, leg. G. Rambold 4498, 4513, 4517, (Hertel, Lecideac. Exs. in prep.); -- Kroombit Tops State Forest, near forest boundary, 24°22'S, 151°00'E, 900 m, 3.ix.1985, leg. R.W.Rogers 7952 (BRIU); -- Mt Tinbeerwah, about 5 km W of Tewantin, 26°23'S, 152°58'E, 250 - 260 m, 13.ix.1986, leg. J.Hafellner 15441 (hb. Hafellner); -- Mt Coolum, c. 90 km N of Brisbane, 26°34'S, 153°05'E, basaltic rocks on southern face at base of the mountain, c. 20 m, 11.ii.1986, leg. G.Rambold 4425, 4427 (M); -- Brisbane, Waterwork Road, [27°28'S, 153°01'E], [no date], leg. F.R.M.Wilson (NSW 180238); -- Mt Cordeaux, southern slope adjacent to the summit track, 28°04'S, 152°24'E, c. 800 m, 17.ix.1986, leg. R.W.Rogers 8500, 8504 (BRIU).



Map 11. Distribution of *Lecanora oreinoides* in continental Australia

New South Wales: 5 km E of Glen Innes along Hwy 38, [29°44'S, 152°00'E], 1000 m, 18.viii.1976, leg. J.A.Elix 2478 (MEL 1024414); -- Walcha, Apsley River, New England, [30°59'S, 151°35'E], 1884, leg. N.R.Crawford (type of *L. mundula* Müll.Arg., G); -- Wingen, [31°53'S, 150°52'E], 1.v.1908, leg. W.D.Filmer (NSW L 3606); -- Mt Wilson, Green Hill, [33°30'S, 150°23'E], 30.xii.1902, leg. J.Gregson (NSW L-3610); -- Blue Mountains, Springwood, Martins Lookout to Glenbrook Creek, 33°43'S, 150°33'E, on exposed sandstone rocks, 31.i.1986, leg. G.Rambold 4100, 4105, 4111 (M); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S facing outcrops of sandstone, 905 m, 1.ii.1986, leg. G.Rambold 4127 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing sandstone cliffs between "The Three Sisters" and "Echo Point", 920 m, 1.ii.1986, leg. G.Rambold 4150 (M); -- Minnamurra Falls Reserve, S of Wollongong, [34°38'S, 150°50'E], 23.ix.1967, leg. W.A.Weber & D.McVean (COLO L-47302); -- Morton National Park, 8 km NE of Nerriga, [34°55'S, 150°15'E], 760 m, 30.iii.1977, leg. J.A.Elix 3060 (ANUC).

A.C.T.: Mt Ainslie, Canberra, [35°17'S, 149°13'E], 2.xi.1967, leg. W.A.Weber (COLO L-47219).

Victoria: Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Ram-bold 3319 (M); -- "Ad saxa arenaria Novae Hollandiae, misit beat. Hochstetter 1861" (type of *Aspicilia oreinoides*, L 910.134-2202).

Lecanora polytropa (Ehrh.) Rabenh.

RABENHORST, Kryptog.-Fl. Deutschl. 2: 37 (1845); ZAHLBRUCKNER, Catal. Lich. Univ. 5: 511 - 514 no. 10528 (1928); WETMORE, Publ. Michigan State Univ., Biol. Ser., 3 (4): 382 (1968); HERTEL, Willdenowia 6: 235 - 236 (1971); MAKAREVICZ, Opredeł. Lischajn. USSR 1: 132 (1971); SANTESSON, Lich. Sweden Norway: 149 (1984); GALLOWAY, Fl. New Zeal. Lichens: 217 (1985).

= *Lichen polytropus* Ehrh., Plantae Crypt. Linn. Exs. no. 294 (1793) - nomen nudum [n.v.].

= *Verrucaria polytropa* Ehrh. in Hoffm., Deutschl. Fl.: 196 (1796).

Type: GERMANY: Harz: "In Hercyniae", EHRHART, Plantae Cryptog. Linneae no. 294 (isotype in LINN-Smith) - [n.v.; according to HERTEL (1971), P.W.James has ensured the identity of this isotype with the modern concept of the species.].

DESCRIPTION (of the lecideoid specimens):

Thallus: cryptothalline, up to 40 mm diam.

HYPOTHALLUS: not obvious.

Apothecia: irregularly roundish to angular, crowded, c. 40/cm², constricted at the base, c. 0.6 - 0.8 mm, max. 0.8 - 1.5 mm diam. Disc subconvex to convex, pale brownish, matt, epruinose. Margin at first obvious, later more or less vanishing, pale whitish, matt.

EXCIPULUM: max. 70 - 100 µm, lateral of hymenium 60 - 80 µm thick. Ectal zone colourless; hyphae c. 6 µm diam., with lumina of 2 - 3 µm. Inner zone colourless, incrustated with lichen substances; hyphae 3 - 4 µm diam., with lumina of c. 1.2 - 1.5 µm. Medullary zone at the basal part of the excipulum, with algal cells.

HYPOTHECIUM: colourless, hyphae c. 3 µm diam.; subhymenial layer colourless.

HYMENIUM: 50 - 55 µm tall, colourless, I± blue, Iconc.± blue. Epithymenium pale brown, c. 15 µm tall. Paraphyses occasionally branched, not anastomosing, c. 1.7 - 2 µm, apices 3 µm thick. Asci c. 30 - 45 x 10 - 12 µm; tholus max. c. 10 µm, min. 2.5 - 3 µm thick; amyloid zone above masse axiale not obvious; outer amyloid wall layer c. 0.2 µm thick, I± blue or -, Iconc.± brown or -; non-amyloid wall layer c. 0.2 µm thick. Spores ellipsoid, 9 - 12 x 4 - 5.5 µm.

Pycnidia: not observed.

CHEMISTRY:

Cortex K + yellow, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-. One chemotype observed, containing usnic acid, zeorin (traces), rangiformic acid (traces) (2 specimens examined).



Map 12. Distribution of *Lecanora polytropa* (lecideoid specimens) in continental Australia

DISTRIBUTION:

Bipolar. This species is widely distributed (HERTEL 1971: 235 - 236), occurring in alpine zones. Within continental Australia it is restricted to the alpine zone of the south-east, growing on siliceous rocks (map 12).

NOTES:

The description of the species refers only to specimens with lecideoid habitus. The apothecia of *L. polytropa* typically show a more or less biatorine to lecanorine margination.

L. polytropa is known to be very variable concerning the development of the thallus. The species is characterized by sessile apothecia with a pale brownish, epruinose disc and margin and by its chemistry. *Lecanora marginata*, another lecideoid representative of *Lecanora* with a bipolar distribution, has a constantly well developed thallus, "biatorine", more or less pruinose apothecia, and a different chemism,

containing usnic acid and atranorin. The differences between several lecideoid species of *Lecanora* are discussed under *L. marginata*.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Charlottes Pass, 36°26'S, 148°20'E, 1820 m, 3.xii.1975, leg. D. Verdon 2005 (CBG); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H. Hertel 31687 (M).

Lecidella Koerb. emend. Hertel & Leuckert

HERTEL & LEUCKERT, Willdenowia 5: 373 (1969); HERTEL, Herzogia 1: 435 (1970); Khumbu Himal 6(3): 317 - 318 (1977); Beih. Nova Hedwigia 79: 449 (1984); HAFELLNER, Beih. Nova Hedwigia 79: 291, 295 (1984).

≡ *Lecidella* Koerb., Syst. Lich. Germaniae: 233 (1855) p.p.

≡ *Lecidea* subg. *Lecidella* (Koerb.) Stiz., Ber. Thätigk. St. Gallischen Naturwiss. Ges.: 162 (1862).

≡ *Lecidea* subg. *Lecidella* (Koerb.) Jatta, Syll. Lich. Ital.: 306 (1900).

≡ *Lecidea* subg. *Lecidella* (Koerb.) Stiz. emend. Hertel, Beih. Nova Hedwigia 24: 26 (1967).

Typus generis: *Lecidella viridans* (Flot.) Koerb. - (lectotype, designated in HERTEL 1967: 26).

The genus *Lecidella* according to its original circumscription by KOERBER (1855) is quite heterogenous, including taxa, which now are regarded as members of the genera *Lecanora*, *Lecidea*, *Rimularia*, and *Tephromela*. In the modern conception (HERTEL 1967, 1977, 1984), *Lecidella* comprises more or less nitrophilous, saxicolous, corticolous, lignicolous and plant debris colonizing species. Among the Lecanoraceae, they are characterized by a thick, lconc.+ orange-red ascus wall, a strong amyloid reaction of the tholus (with an amyloid zone above the masse axiale), simple paraphyses and filiform conidia. Several species contain xanthonenes. The delimitation of *Lecidella* will be discussed in detail by KNOPH (in prep.) and KNOPH & RAMBOLD (in prep.).

Lecidella buelliastrum (Müll.Arg.) Knoph & Rambold **comb. nov.**

≡ *Lecidea buelliastrum* Müll.Arg.

ZAHLEBRUCKNER, Catal. Lich. Univ. 3: 530 no. 6231 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1973); FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); Checklist Austr. Lich. 2. ed.: 57 (1986); Austr. Fl. Fauna Ser. 4: 113 (1986); Checklist Austr. Lich. 3. ed.: 18, 101 (1988).

Type: AUSTRALIA: New South Wales: Guntawang, Cudgegong River, [comm.] 1885, leg. J.Hamilton [comm. F.v.Müller] (G!), holotype; the "isotype" MEL 7018 belongs to *Buellia* !).

DESCRIPTION:

Thallus: areolate, up to 60 mm diam., c. 0.2 - 1.0 mm thick.

AREOLES: irregularly shaped to roundish, white to creamy white, plane to convex, with smooth to rough surface, c. 0.5 - 0.8 mm, max. 0.6 - 1.5 mm diam. Cortex 10 - 20 µm thick; upper cell layer not pigmented; hyphae c. 3 - 4 µm diam.; epinecral layer not developed. Algal layer c. 40 - 70 µm thick; algal cells c. 9 µm, max. 13 µm diam. Medulla I -; hyphae c. 3 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed, 60 - 90/cm², more or less constricted at the base, c. 0.35 - 0.5 mm, max. 0.4 - 0.8 mm diam. Disc more or less convex, black, subnitid, epruinose. Margin at first distinct, later vanishing, black, matt to subnitid.

EXCIPULUM: max. 20 - 50 µm, lateral of hymenium 20 - 40 µm thick. Ectal zone dark grey to pale grey-brown; pigmented zone 15 - 20 µm tall; hyphae c. (3 -) 4 - 5.5 µm diam., with lumina of 1 - 1.3 µm. Inner zone colourless to grey; hyphae 3 - 4.5 µm diam., with lumina of c. 1 µm. Medullary zone not obvious.

HYPOTHECIUM: colourless to pale brownish, up to c. 200 µm thick; subhypotheccial zone K ± orange-brown; hyphae 2.5 - 3.5 µm diam.; subhymenial layer not distinct.

HYMENIUM: 50 - 60 µm tall, colourless, I± blue, I_{conc.} -. Epihymenium green to black-green, 10 - 14 µm tall. Paraphyses occasionally branched and anastomosing, 1.5 - 2 µm, apices 3 - 3.5 µm thick. Asci c. 40 - 48 x 10 - 15 µm; tholus max. 7 - 8 µm, min. 4 - 6 µm thick; masse axiale 2 - 3 µm broad; ocular chamber obvious; outer amyloid wall layer c. 1.1 - 1.3 µm thick, I+ brown, I_{conc.}+ red-brown; non-amyloid wall layer c. 0.5 µm thick. Spores ellipsoid, 10 - 11 - 13 x 5 - 6 - 6.5 µm.

Pycnidia: immersed. Conidia filiform, curved, c. 13 - 25 x 1 µm.

CHEMISTRY:

Cortex K + yellow, P± yellow, C± orange; medulla K-, P-, C-; excipulum K-, P-, C-.

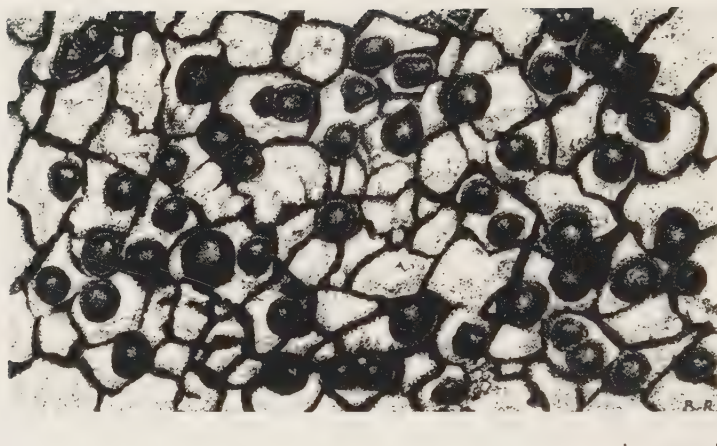


Fig. 10. *Lecidella buelliastrum*. (GR 4083, M) Scale = 1 mm.

Two chemotypes observed:

- a) containing atranorin, caloploicin, diploicin and 3-O-methyl-4,5,7-trichloronorlichexanthone (O-methylasemon);
- b) containing additional thiophanic acid;
(in total 18 specimens examined).

DISTRIBUTION:

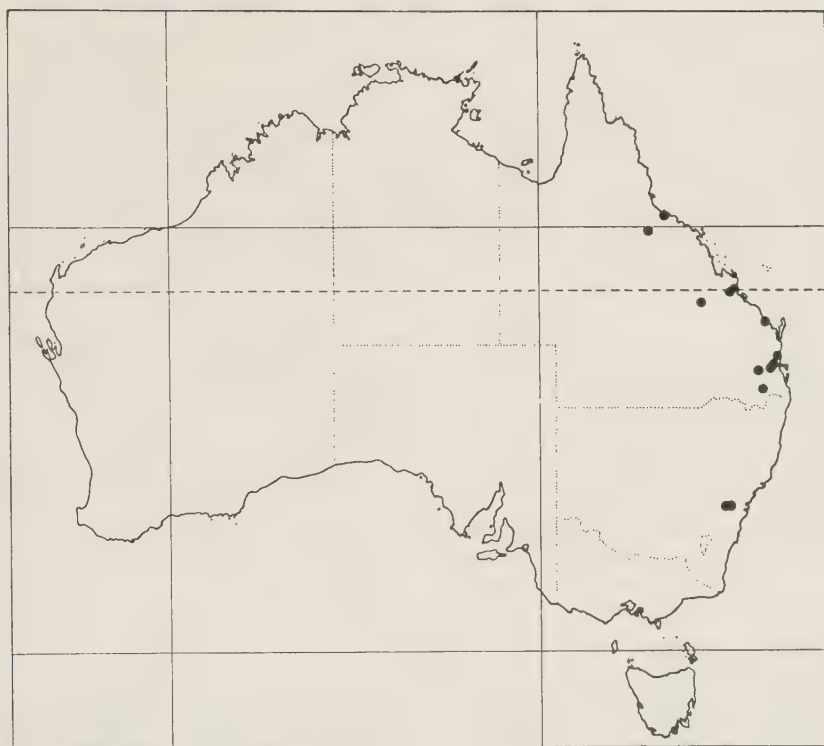
Southern xeric. Within continental Australia, the species is restricted to Qld and N.S.W., growing at lower altitudes on exposed siliceous rocks (map. 13). *L. buelliastrum* also occurs in South Africa (KNOPH in litt.).

NOTES:

L. buelliastrum is characterized by a usually well developed thallus, relatively small apothecia with vanishing margin, a pale brownish to colourless hypothecium and the content atranorin, caloploicin, diploicin, 3-O-methyl-4,5,7-trichloronorlichexanthone (O-methylasemon) and facultatively additional thiophanic acid. The anatomically similar species *Lecidella enteroleucella* contains arthothelin and thuringione (along with some other xanthones and atranorin), has a wider distribution, occurring in eastern and south-eastern Asia, in addition to Australia and South Africa.

SPECIMENS EXAMINED:

Queensland: Mt Elliot National Park, c. 30 km SE of Townsville, near Alligator Creek Falls, 19°28'S, 147°00'E, boulders in open forest, 220 m, 24.ii.1986, leg. G.Rambold 4727 (M); -- 12 km W of Charters Towers, beside Flinders Highway, 20°07'S, 146°10'E, SE exposed rocky outcrops on slope, 340 m, 23.ii.1986, leg. G.Rambold 4702, 4704 (M); -- Rosslyn Bay, Double Head, 35 km NE of Rockhampton, 23°10'S, 150°48'E, rocky outcrops on top of hill, c. 50 m, 13.ii.1986, leg. G.Rambold 4463 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S,



Map 13. Distribution of *Lecidella buelliastrum* in continental Australia

150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, leg. G.Rambold 4446 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, vertical and overhanging surface of E exposed rocky outcrops, 480 m, 13.ii.1986, leg. G.Rambold 4455 (M); -- Blackdown Tableland National Park, Stony Creek Lookout, 23°47'S, 149°00'E, outcrops of sandstone, c. 720 m, 15.ii.1986, leg. G.Rambold 4519, 4520 (M); -- Bargara, on the seafront, 24°49'S, 152°28'E, 3 m, 21.iv.1984, leg. R.W.Rogers 2809 (BRIU); -- Mt Coolum, c. 90 km N of Brisbane, 26°34'S, 153°05'E, basaltic rocks on southern face at base of the mountain, c. 20 m, 11.ii.1986, leg. G.Rambold 4423, 4428 (M); -- Glasshouse Mountains, N-facing hills SSW of Tibrogargan Mtn, 26°57'S, 152°56'E, 100 - 150 m, 19.viii.1986, leg. J.Hafellner 15717 (hb. Hafellner); -- Mt Mee State Forest, about 3 km W of the forest station, 27°04'S, 152°44'E, c. 500 m, 13.viii.1986, leg. J.Hafellner 15644 (hb. Hafellner); -- Perserverance Dam SE of Crows Nest, 27°17'S, 152°08'E, c. 480 m, 4.ix.1986, leg. J.Hafellner 15385, 15399 (hb. Hafellner); -- Perserverance Dam SE of Crows Nest, 4.ix.1986, leg. R.W.Rogers (BRIU); -- Cunningham Gap National Park, S exposed ridge of Mt Cordeaux, 28°02'S, 152°23'E, c. 1000 m, 17.ix.1986, leg. J.Hafellner 15362 (hb. Hafellner).

New South Wales: Guntawang, Cudgegong River, [no date], leg. A.A. Hamilton (type of *Lecidea buelliastrum* Müll. Arg. G); -- Blue Mountains, Springwood, Martins Lookout to Glenbrook Creek, 33°43'S, 150°33'E, on exposed sandstone rocks, 31.i.1986, leg. G.Rambold 4083 (M), 4096 (Hertel, *Lecideac. Exs. in prep.*), 4098, 4110, 4112 (M), 4099 (M, NSW); -- Blue Mountains, Springwood, c. 80 km W of Sydney, Martins Lookout to Glenbrook Creek, [33°43'S, 150°33'E], ix.1981, leg. M.Mayrhofer 3284, 3387 (GZU); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S facing outcrops of sandstone, 905 m, 1.ii.1986, leg. G.Rambold 4118 (M); -- Blue Mountains, "Narrow Neck", 4.5 km SW of Katoomba, 33°45'S, 150°16'E, sandstone outcrops beside road, c. 1000 m, 2.ii.1986, leg. G.Rambold 4208 (M); -- Blue Mountains National Park, near Glenbrook, c. 60 km W of Sydney, [33°46'S, 150°37'E], ix.1981, leg. M.Mayrhofer 3266 (GZU).

***Lecidella enteroleucella* (Nyl. in Nyl. & Cromb.) Hertel**

HERTEL, Khumbu Himal 6 (3): 330 - 332 (1977).

= *Lecidea enteroleucella* Nyl. in Nyl. & Cromb., J. Linn. Soc., Bot. 20: 67-68 (1883); ZAHLBRÜCKNER, Catal. Lich. Univ. 3: 575 no. 6422 (1925).

Type: JAPAN: Kyushu: Nagasaki, 1861, leg. A.C.Maingay (BM ex K, lectotype - designated in KNOPH in prep.; BM, FH, isotypes) - [fide KNOPH (in litt.)].

DESCRIPTION:

Thallus: rimose-areolate, up to 50 mm diam., 0.15 - 0.2 mm thick.

AREOLES: irregularly shaped, occasionally with undulating margins, creamy to greenish-white, plane, with smooth to rough surface, c. 0.2 - 0.3 mm, max. 0.3 - 0.7 mm diam. Cortex c. 20 µm thick; upper cell layer colourless; hyphae c. 4 µm diam.; epinecral layer up to c. 5 µm or not developed. Algal layer c. 80 µm thick; algal cells c. 9 - 10 µm, max. 12 µm diam. Medulla I± brownish; hyphae c. 4 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: round, dispersed, 30 - 80/cm², sessile, not constricted at the base, c. 0.3 - 0.4 mm, max. 0.35 - 0.5 mm diam. Disc plane to subconvex, black to black-brown, matt, epruinose. Margin more or less distinct, later vanishing, black, matt.

EXCIPULUM: if developed, max. 30 - 40 µm, lateral of hymenium 30 - 40 µm thick, or reduced. Ectal zone pale grey-brown; pigmented zone 15 - 20 µm thick; hyphae 4.5 - 6.5 µm diam., with lumina of c. 1 - 1.3 µm. Inner zone colourless to pale brown; hyphae c. 4 - 5 µm diam., with lumina of c. 1 µm. Medullary zone not obvious.

HYPOTHECIUM: colourless, hyphae 3 - 3.5 µm diam.; subhymenial layer colourless.

HYMENIUM: 45 - 60 µm tall, colourless, I± blue, Iconc. -. Epihymenium dark green to brown-green, 8 - 10 µm tall. Paraphyses occasionally branched and anastomosing, 1.5 - 2 µm, apices 3 - 4 µm thick. Asci c. 45 - 55 x 7 - 14 µm; tholus max. 6.5 - 11 µm, min. 1.5 - 5 µm thick; masse axiale c. 2 - 3 broad; amyloid zone above masse axiale c. 1 - 2 µm thick; outer amyloid wall layer 0.8 - 1.2 µm thick, I+ brown,

Iconc. + red-brown; non-amyloid wall layer c. $0.5\ \mu\text{m}$ thick. Spores ellipsoid, $8 - 12 \times 4.5 - 6\ \mu\text{m}$.

Pycnidia: immersed. Conidia filiform, curved, c. $15 - 25 \times 1\ \mu\text{m}$.

CHEMISTRY:

Cortex K + yellow, P ± yellow, C ± orange; medulla K-, P-, C-; excipulum K-, P-, C ± orange.

One chemotype observed, containing atranorin, arthothelin, thuringione and 3,6-di-O-methyl-2,4,5-trichloronorlichexanthone (7 specimens examined).

DISTRIBUTION:

New to Australasia! This (sub-) tropical species is hitherto known to occur in eastern and south-eastern Asia (China, Taiwan, Korea, Japan, India, Indonesia) (HERTEL 1977: 332) and South Africa (KNOPH in prep.). Within Australia, *L. enteroleucella* is restricted to Qld (map 14), growing on exposed siliceous rock.



Map 14. Distribution of *Lecidella enteroleucella* in continental Australia

NOTES:

L. enteroleucella is characterized by a well developed thallus, relatively small apothecia, a colourless hypothecium and the presence of arthothelin and thuringione (and several other xanthonenes along with atranorin). *L. stigmatea* differs in that it usually has larger spores, a less developed thallus, lacks xanthonenes and has a different, not tropical distribution. These differences will be illuminated in detail by KNOPH (in prep.). *L. buelliastrum*, which is anatomically quite similar to *L. enteroleucella*, shows an unpigmented to pale brownish hypothecium and contains caloploicin, diploicin and 3-O-methyl-4,5,7-trichloronorlichexanthonone along with atranorin and facultatively additional thiophanic acid.

Another similar species is *Lecidella chodati* (Samp.) Knoph & Leuckert. This species, which also was found in Australia (N.S.W.) in one collection (GR 3678), will be described in detail by KNOPH (in litt.). *L. chodati* constantly contains chodatin and demethylchodatin along with atranorin and several xanthonenes (isoarthothelin, thiophanic acid and 2,5,7-trichlor-3-O-methylnorlichexanthonone) and has a less contiguous thallus than *L. enteroleucella*.

SPECIMENS EXAMINED:

Queensland: 12 km W of Charters Towers, beside Flinders Highway, 20°07'S, 146°10'E, SE exposed rocky outcrops on slope, 340 m, 23.ii.1986, leg. G.Rambold 4713 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, leg. G.Rambold 4445 (M); -- Noosa National Park, SE of Noosa Heads, Dolphin Point, 26°23'S, 153°07'E, 10 - 20 m, 13.ix.1986, leg. J.Hafellner 15475 (hb. Hafellner), 15479 (hb. Hafellner, GZU); -- Woodford Road N of Dayboro, Terrors Creek, 27°09'S, 152°50'E, c. 300 m, 13.viii.1986, leg. J.Hafellner 15655 (hb. Hafellner); -- Point Lookout, 27°26'S, 153°34'E, 5 m, 4.xii.1981, leg. R.W.Rogers 2485 (BRIU); -- Brisbane, [27°28'S, 153°01'E], [no date], leg. F.R.M.Wilson (NSW 155845).

Lecidella stigmatea (Ach.) Hertel & Leuck.

HERTEL & LEUCKERT, Willdenowia 5: 375 (1969); HERTEL, Herzogia 1: 436 (1970); Herzogia 2: 56 - 57 (1970); Willdenowia 6: 251 (1971); Herzogia 2: 256 (1971); Mitt. Bot. Staatssamml. München 12: 474 (1976); Khumbu Himal 6 (3): 334 - 337 (1977); Mitt. Bot. Staatssamml. München 17: 181 - 182 (1981); SANTESSON, Lich. Sweden Norway: 189 (1984), HERTEL, Beih. Nova Hedwigia 79: 451 (1984); Mitt. Bot. Staatssamml. München 21: 325 (1985); GALLOWAY, Fl. New Zeal. Lich.: 636 (1985); NIMIS & POELT, Studia Geobot. 7, suppl. 1: 132 (1987).

= *Lecidea stigmatea* Ach., Lich. Univ.: 161 (1810); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 568, 718 (1925) - sub *L. elaeochroma* et *L. vulgata*; POELT, Ber. Bayer. Bot. Ges. 34: 88 - 90 (1961); ANDERSON, Genus *Lecidea* Rocky Mtns Nat. Park: 53 - 56 (1964).

Type: SWITZERLAND: [no locality, no date], leg. J.Schleicher 696-a (H-Ach, lectotype - designated in HERTEL 1970c; UPS, isotype).

DESCRIPTION:

Thallus: verrucose to areolate, up to 70 mm diam., 0.2 - 0.6 mm thick.

AREOLES: irregularly shaped, white to creamy white, plane to irregularly convex, with smooth to rough surface, c. 0.3 - 0.6 mm, max. 0.7 - 1.1 mm diam. Cortex 15 - 20 μ m thick; upper cell layer not pigmented; hyphae c. 3.5 - 6 μ m diam.; epinecral layer up to c. 12 μ m thick. Algal layer c. 70 μ m thick; algal cells c. 10 - 11 μ m, max. 14 - 15 μ m diam. Medulla I -; hyphae 3 - 4 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: round to roundish, dispersed, 10 - 30/cm², sessile, mostly constricted at the base, c. 0.5 - 0.9 mm, max. 0.8 - 1.4 mm diam. Disc plane to convex, black, matt to subnitid, epruinose. Margin at first distinct, later persistent or vanishing, black, nitid.

EXCIPULUM: max. 50 - 150 μ m, lateral of hymenium 50 - 120 μ m thick. Ectal zone grey-green; pigmented zone 15 - 20 μ m thick; hyphae 5 - 9 μ m diam., with lumina of (1 -) 2 - 3.5 μ m. Inner zone colourless to weakly tinged red-brown; hyphae 5.5 - 7 μ m diam., with lumina of 1 - 2.5 μ m. Medullary zone more or less developed, in part containing algal cells.

HYPOTHECIUM: colourless, hyphae 3 - 4 μ m diam.; subhymenial layer colourless.

HYMENIUM: 60 - 90 μ m tall, colourless to pale red-brown, I $\pm$ blue, Iconc. -. Epihymenium dark green to black-brown, c. 8 - 12 μ m tall. Paraphyses occasionally branched, rarely anastomosing, 1.5 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 45 - 80 x 14 - 20 μ m; tholus max. 12 - 16 μ m, min. 6.5 - 9 μ m thick; masse axiale 3 - 3.5 μ m broad; amyloid zone above the masse axiale c. 3 - 6 μ m thick; outer amyloid wall layer 1 - 2 μ m thick, I+ brown, Iconc.+ red-brown; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 13 - 17 x (5 -) 6 - 9 μ m.

Pycnidia: immersed. Conidia filiform, curved, c. 20 - 30 x 1 μ m.

CHEMISTRY:

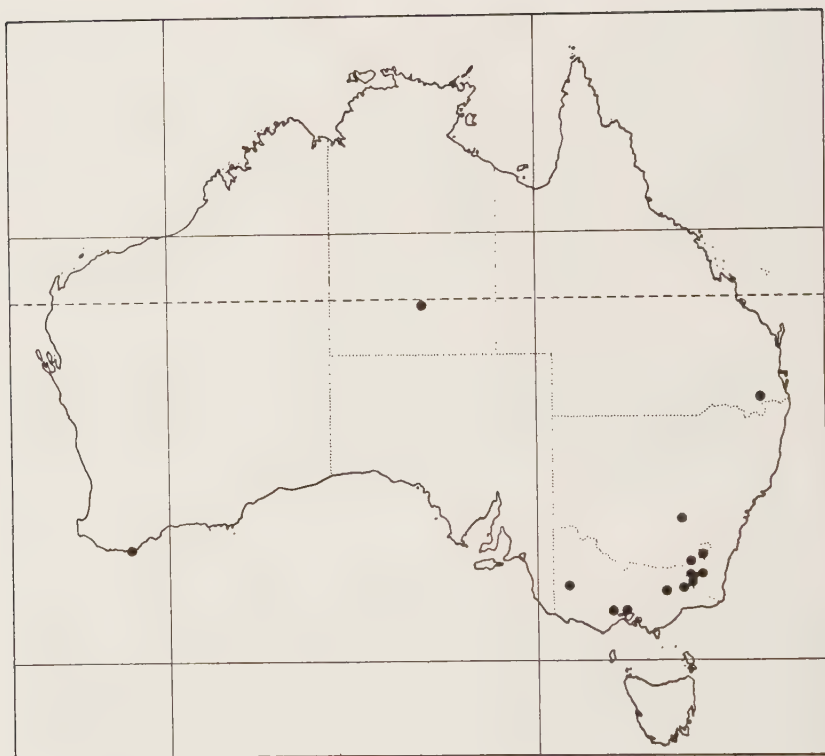
Cortex K+ yellow or K-, P $\pm$ yellow, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

3 chemotypes observed:

- a) containing no lichen substances (7 specimens examined);
- b) containing atranorin (11 specimens examined);
- c) containing atranorin, zeorin (6 specimens examined).

DISTRIBUTION:

Cosmopolitan. New to Australia! This nitrophilous species has a worldwide distribution, occurring in extra-tropical regions from sea-level to the alpine zone, growing on calcareous or siliceous rock. For further notes on the distribution of *L. stigmathea* compare HERTEL (1977: 336 - 337)! Within continental Australia, the species is widely distributed in the extra-tropical regions of W.A., N.T., Qld, N.S.W., A.C.T. and Vic. (map 15) and can also be expected in Tasmania.



Map 15. Distribution of *Lecidella stigmatea* in continental Australia

NOTES:

The ecological range of *L. stigmatea*, which occurs in central Australia as well as in the Snowy Mountains at an altitude of c. 2000 m, growing on calcareous or on siliceous rock, is striking. HERTEL (1977: l.c.) assumes, that the species is probably heterogenous, but found no criteria for a satisfying segregation. In this study the examination of the Australian material revealed no correlations of characters either, so a separation into more entities was not possible.

According to the observations of Prof. Ch. Leuckert (unpubl.) and J.-G.Knoph (in litt.), who examined a large number of extra-Australian specimens, *L. stigmatea* constantly contains zeorin, often along with lichexanthone or atranorin. In some Australian specimens of *L. stigmatea*, no zeorin has been found. This substance was either present in small traces and therefore overlooked, or the material belongs to a separate chemical strain or species. To determine this,

further chemical investigations on more material from various regions of Australia are necessary.

SPECIMENS EXAMINED:

Western Australia: 1 km E of Lower King townsite near Albany, [35°00'S, 117°52'E], 18.iv.1980, leg. D.H.S.Richardson 146 (PERTH).

Northern Territory: Alice Springs, Alice Springs Telegraph Station Historical Reserve, 23°40'S, 133°53'E, conglomerate sandstone boulders (S aspect) near carpark, c. 600 m, 15.iii.1986, leg. G.Rambold 5026 (M).

Queensland: Cunninghams Gap National Park, S exposed ridge of Mt Cordeaux, 28°02'S, 152°23'E, c. 1000 m, 17.ix.1986, leg. J.Hafellner 15317, 15329 (hb. Hafellner).

New South Wales: Weddin Range, 15 km W of Grenfell, 33°54'S, 148°01'E, 430 m, 17.x.1984, leg. J.A.Elix 17678 (ANUC); -- Kosciusko National Park, Yarrangobilly Caves, 35°43'S, 148°29'E, rocks of limestone around "Glory Hole Cave" carpark, 1060 m, 21.i.1986, leg. G. Rambold 3766, 3770, 3773 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G. Rambold 3657 (M); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, c. 1620 - 1680 m, 3.iii.1985, leg. H.Hertel 31847 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31760, 31757, 31769 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3420 (M); -- West bank of Lake Jindabyne, 2.5 km NW of Jindabyne, 36°25'S, 148°36'E, granitic boulders in pasture land beside road to Charlottes Pass, c. 900 m, 13.i.1986, leg. G.Rambold 3383 (M); -- Southern Tablelands, Jacobs River Bridge, 27 km SE of Thredbo, 36°44'S, 148°26'E, 350 m, 21.ix.1978, leg. D.Verdon 3638 (CBG).

A.C.T.: Naas River, 33 km SSE of Canberra, 35°32'S, 149°05'E, 26.vi.1979, leg. H.Streimann 7916A (CBG); -- Kowen forest, 730 m, 21.xi.1975, leg. J.A.Elix 1333 (ANUC).

Victoria: Mt Arapiles Forest Park Picnic Ground, 35 km W of Horsesham, 36°45'S, 141°50'E, 16.viii.1981, leg. M.& H.Mayrhofer 2998 (GZU); -- Limestone State Forest E of Benambra, Limestone Creek, 36°51'S, 148°03'E, 980 - 1010 m, 27.ii.1985, leg. H.Hertel 31460, 31462, 31466 (M); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derriek Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3022 (M, MEL); -- Kew Asylum Grounds, [37°48'S, 145°01'E], 12.v.1900, leg. R.A.Bastow 53 (MEL); -- Kew, [37°48'S, 145°01'E], 8.viii.1885, leg. F.R.M.Wilson (NSW 155855); -- Brisbane Ranges, Little River Gorge, c. 25 km S of Bacchus Marsh, 37°51'S, 144°22'E, 18.x.1981, leg. H.Mayrhofer 3018 (GZU); -- Greengrove Mid..ham (?), iii.1897, leg. F.R.M.Wilson (NSW 155759); -- Tandarook, i.1885, leg. F.R.M.Wilson (NSW 155792).

***Lecidella sublapicida* (Knight) Hertel**

HERTEL, Mitt. Bot. Staatssamml. München 19: 444 - 445 (1983); Beih. Nova Hedwigia 79: 451 (1984).

= *Lecidea sublapicida* Knight, Trans. & Proc. New Zealand Inst. 8: 316 (1876); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 701 no. 6775 (1925); GALLOWAY, Fl. New Zeal. Lich.: 239, 637 (1985).

Type: NEW ZEALAND: [no locality, probably Wellington area, no date], leg. Ch. Knight (BM, lectotype¹⁾ - designated in KNOPH in prep.; M, W, isotypes).

= *Lecidea tristicula* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 1: 46 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 710 no. 6821 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 51 (1983); Austr. Fl. Fauna Ser. 4: 132 (1986).

= *Lecidella tristicula* (Müll.Arg.) Hertel, Mitt. Bot. Staatssamml. München 19: 445 (1983); FILSON, Checklist Austr. Lich. 2. ed.: 65 (1986); Checklist Austr. Lich. 3. ed.: 17, 107 (1988).

Type: AUSTRALIA: Victoria: Melbourne, Kew, 1891, leg. F.R.M. Wilson (G!, holotype; "isotype" in MEL belongs to *Buellia*; NSW 1412, isotype according to FILSON 1986b - n.v.) - [not analyzed chemically, too poorly developed].

= *Lecidea nesophila* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 3: 641 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 640 no. 6583 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 53 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 124 - 125 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988).

Type: AUSTRALIA: Queensland: Thursday Island, [no date], leg. C. H. Hartmann (comm. Ch. Knight 1887) (G!, holotype) - [type locality probably not correct, see p. 319] - [not analyzed chemically, too poorly developed].

DESCRIPTION:

Thellus: areolate to verrucose, up to 60 mm diam., 0.1 - 0.3 mm thick.
AREOLES: irregularly shaped to roundish, dirty whitish, more or less

1) HERTEL (1984) used as a type specimen an original collection of Ch. Knight showing a totally unpigmented hypothecium. KNOPH (in litt.) suggests a different lectotypification using a specimen with a brownish hypothecium (for this is in better harmony with the protologue). This change in lectotypification causes the synonymisation of *Lecidella tristicula* with *L. sublapicida*.

plane, with rough surface, c. 0.1 - 0.4 mm, max. 0.2 - 0.7 mm diam. Cortex: hyphae c. 4 μ m diam.; epinecral layer not observed. Algal cells c. 9 - 11 μ m, max. 10 - 16 μ m diam. Medulla I -; hyphae 3 - 5 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: round, dispersed, 40 - 110/cm², more or less constricted at the base, c. 0.3 - 0.6 mm, max. 0.4 - 1.1 mm diam. Disc plane to convex, black, matt, epruinose. Margin at first mostly distinct, later vanishing, black, matt to subnitid.

EXCIPULUM: max. 50 - 90 μ m, lateral of hymenium 30 - 60 μ m thick. Ectal zone pale grey-green to grey-brown; pigmented zone 15 - 25 μ m thick; hyphae 5 - 6 (- 8) μ m diam., with lumina of 1 - 1.5 μ m. Inner zone orange-brown to dark brown; hyphae 4 - 4.5 μ m diam., with lumina of c. 1 μ m. Medullary zone not developed.

HYPOTHECIUM: orange brown, 100 - 400 μ m thick; hyphae 3 - 4 μ m diam.; subhymenial layer colourless to orange brown, 20 - 40 μ m thick.

HYMENIUM: (50 -) 60 - 80 μ m tall, colourless, I $\pm$ blue, I_{conc.} -. Epihymenium green, 10 - 15 μ m tall. Paraphyses more or less branched, occasionally anastomosing, 1.5 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 45 - 60 x 12 - 15 μ m; tholus max. 10 - 14 μ m, min. 3.5 - 8 μ m thick; masse axiale 2 - 3 μ m broad, ocular chamber distinct; outer amyloid wall layer 1.2 - 2 μ m thick, I+ brown, I_{conc.}+ red-brown; non-amyloid wall layer 0.3 - 0.5 μ m thick. Spores ellipsoid, 9.5 - 10.0 - 10.6 - 15 x 5 - 5.7 - 6.7 - 8 μ m.

Pycnidia: not observed.

CHEMISTRY:

Cortex K -, P-, C- or C+ orange; medulla K-, P-, C-; excipulum K-, P-, C-.

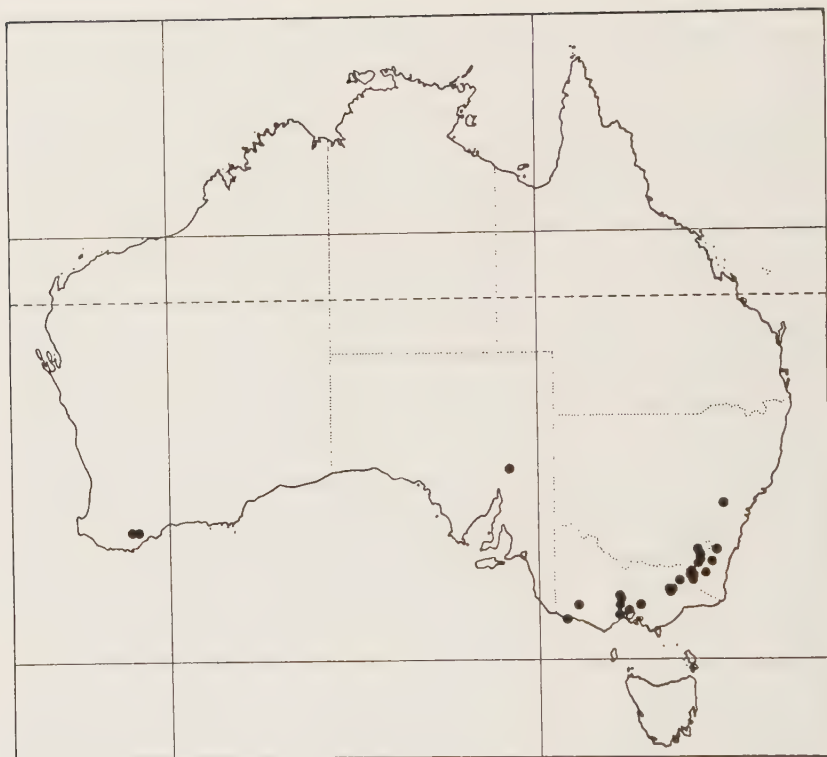
One chemotype observed, containing vicanicin, vicanicin-monomethylether, isoarthothelin (2,5,7-trichloronorlichexanthone), 3-O-methyl-2,5,7-trichloronorlichexanthone in various concentrations (52 specimens examined).

DISTRIBUTION:

Australasian(?). In continental Australia the species occurs in W.A., S.A., N.S.W., A.C.T. and Vic. (map 16), growing on exposed siliceous rock from low altitudes to the alpine zone. No reports yet exist for Tasmania. The type material of *L. nesophila*, a synonym of *L. sublapicida*, was collected on Thursday Island, according to the original description and the herbarium label, is certainly derived from New Zealand or the southern part of Australia.

NOTES:

L. sublapicida is characterized by its chemistry (containing vicanicin, vicanicin monomethylether, 2,5,7-trichloronorlichexanthone, 3-O-methyl-2,5,7-trichloronorlichexanthone as major substances) and an orange-brown hypothecium. *L. sublapicida* is anatomically rather similar to the widely distributed *Lecidella carpathica* Koerb., which con-



Map 16. Distribution of *Lecidella sublapicida* in continental Australia

tains atranorin (+ chloroatranorin), thuringione and diploicin (HUNECK & SANTESSON 1969, LEUCKERT & al. in press) and shows a more yellowish-brown pigmentation of the hypothecium. The latter species was not found in Australia.

SPECIMENS EXAMINED:

Western Australia: Stirling Range National Park, Bluff Knoll, 34°23'S, 118°15'E, exposed sandstone outcrops on peak SW of summit, c. 1000 m, 3.iv.1986, leg. G.Rambold 5400, 5401, 5408, 5409 (M); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, leg. G.Rambold 5331, 5332, 5335, 5336, 5339 (M).

Queensland: Thursday Island, [10°35'S, 142°13'E], [no date], leg. C.H. Hartmann (?) (type of *Lecidea nesophila* Müll.Arg., G) - [locality probably not correct, see p. 319].

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G. Rambold 5476, 5506, 5546 (M).

New South Wales: Great Dividing Range, S of Hartley, SW of Ka-toomba, 33°15'S, 150°10'E, c. 850 m, 30.ix.1981, leg. M.& H. Mayrhofer 3392 (GZU); -- Wiagdon Hill, about 4 mi S of Wattle Flats P.O., on road from Safali (= Sofala?) to Bathurst, 11.xii.1967, leg. R.& R. Belcher 1604 (COLO); -- Great Dividing Range, 12.6 km E of Bungendore, [35°15'S, 149°45'E], 850 m, 23.iii.1977, leg. J.A.Elix 2975 (ANUC); -- 28 km W of Canberra, Mt Coree summit, [35°18'S, 148°49'E], 1400 m, 23.vii.1975, leg. D. Verdon 1523 (CBG, H, NICH); -- Gourrock Range, along Cowangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G. Rambold 3960 (M); -- 17 km ESE of Michelago, Michelago - Jingera Track, 35°45'S, 149°21'E, dry sclerophyll forest on gentle slope, 970 m, 26.i.1986, leg. G. Rambold 3941, 3942 (M); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G. Rambold 3761 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G. Rambold 3662 (M, NSW); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G. Rambold 3704 (M), 3711 (M, NSW); -- Kosciusko National Park, summit of Round Mtn, 28 km NE of Khancoban, 36°17'S, 148°35'E, 1750 m, 10.iv.1985, leg. J.A.Elix 19090 (ANUC); -- Kosciusko National Park, Snowy River Valley near Island Bend, 36°20'S, 148°28'E, 1260 - 1280 m, 3.iii.1985, leg. H. Hertel 31890 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G. Rambold 3612, 3631 (M); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, c. 1620 - 1680 m, 3.iii.1985, leg. H. Hertel 31830 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H. Hertel 31771 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G. Rambold 3422, 3438, 3448, 3458, 3459 (M); -- Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake, 1720 m, 14.i.1986, leg. G. Rambold 3468 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G. Rambold 3477, 3509 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G. Rambold 3513 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, 2000 m, 17.i.1986, leg. G. Rambold 3585, 3602 (M); -- Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, leg. G. Rambold 3563, 3571 (M); -- Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H. Hertel 31672, 31684, 31688 (M); -- 28 km SSW of Jindabyne, near Ingebura, 36°39'S, 148°30'E, big and small granitic boulders in pasture land beside Buchan - Jindabyne road, c. 950 m, 13.i.1986, leg. G. Rambold 3369 (M); -- Kenmore, [no date, no collector], (NSW 155751).

A.C.T.: Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, 1420 m, 18.xii.1985, leg. J.A.Elix 19774 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks 1480 m, 27.i.1986, leg. G. Rambold 4041 (M); -- Near summit of Mt Franklin, above road to Mt Ginini, [35°29'S, 148°47'E], 1585 m, 26.ii.1975, leg. J.A.Elix 593 (ANUC); -- Bimberi Peak, 35°40'S, 148°48'E, 1800 - 1880 m, 20.x.1981, leg. V. Wirth 11174 (STU).

Victoria: Great Dividing Range, on road from Omeo to Corroyong, c. 10 km S of Sassafras Gap (75 km S of Corroyong), 36°39'S, 147°42'E, c. 800 m, 28.ii.1985, leg. H. Hertel 31590 (M); -- Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G. Rambold 3117, 3129 (M); -- Bogong High Plains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, c. 1600 m, 26.ii.1985, leg. H. Hertel 31451, 31503 (M); -- Bogong

National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3063 (M); -- Mt Loch, 6114 ft, 16.ii.1967, leg. R.Filson 9828 (MEL); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3001, 3027, 3040 (M, MEL), 3002 (M); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3090 (M, MEL); -- Kyneton, [37°15'S, 144°27'E], 10.v.1897, leg. F.R.M.Wilson (NSW 155848); -- Hanging Rock, 7 km NE of Woodend, 37°20'S, 144°36'E, 28.viii.1981, leg. M. & H. Mayrhofer 3083 (GZU); -- Dunkeld, [37°39'S, 142°21'E], 12.iv.1896, leg. F.R.M.Wilson (NSW 155857); -- W of Djerriwarrah Creek watershed, 1 km N of Anthony's cutting, Great Western Hwy, 10 km E of Bacchus Marsh, [37°41'S, 144°33'E], 31.i.1984, leg. P.W.James (BM); -- Yalla-y-poorra, 1895, leg. F.R.M.Wilson (COLO L-53919); -- Yalla-y-poorra, [no date], leg. (?) F.R.M.Wilson (NSW 155828); -- Yalla-y-poorra, Streatham, xi.1888, leg. F.R.M.Wilson (NSW 155839); -- Melbourne, Mt Donna Buang, [37°42'S, 145°41'E], iii.1963, leg. P.W.James (BM); -- Kew, [37°48'S, 145°01'E], 1891, leg. F.R.M.Wilson (type of *Lecidea tristicula* Müll.Arg., G); -- Baw Baw National Park, Mt Erica, 37°52'S, 146°22'E, 1200 m, 9.i.1986, leg. G.Rambold 3203 (M); -- Point Wilson, 15 km NE of Geelong, [38°06'S, 144°30'E], iii.1980, leg. A.Geddes (MEL 1029151); -- Portland, [38°21'S, 141°36'E], xi.1896, leg. F.R.M.Wilson (NSW 155803).

***Miriquidica* Hertel & Rambold**

HERTEL & RAMBOLD, Mitt. Bot. Staatssamml. München 23: 378 - 382 (1987).

Typus generis: *Miriquidica complanata* (Koerb.) Hertel & Rambold - (holotype).

The recently described genus *Miriquidica* is closely related to the genera *Protoparmelia* Choisy, *Bryonora* Poelt and *Psorinia* Schneider. The latter two are not known in Australia. *Miriquidica* is characterized by asci with weakly amyloid tholus, without an amyloid zone above the masse axiale, and a thin outer amyloid wall layer. The spores are non-septate and the conidia filiform. Characteristic lichen substances of *Miriquidica* are miriquidic acid, lobaric acid, and norstictic acid. The genus includes only saxicolous species, growing on siliceous rock. For further discussions concerning the delimitation of this genus see HERTEL & RAMBOLD (1987: 379 - 380) and RAMBOLD & SCHWAB (in press).

***Miriquidica deusta* (Stenham.) Hertel & Rambold**

HERTEL & RAMBOLD, Mitt. Bot. Staatssamml. München 23: 380, 383 (1987).

= *Lecidea fuscoatra* var. *deusta* Stenham., Novae Sched. Crit. Lich. Suec. XIV, 9 (1833).

= *Lecanora deusta* (Stenham.) Nyl., Flora 52: 552 (1872) [non *Lecanora deusta* (Trev.) Zahlbr. - nomen illegit.].

= *Lecidea deusta* (Stenham.) Nyl. in Brenner, Memoranda Soc. Fauna Fl. Fenn. 13: 96 (1886) [nomen illegit. - non *Lecidea deusta* (L.) Spreng., 1827].

= *Lecidea deustata* Zahlbr. [nomen novum pro *L. deusta* (Stenham.) Nyl.], Catal. Lich. Univ. 3: 754 no. 6983 (1925); SANTESSON, Lich. Sweden Norway: 163 (1984); NIMIS & POELT, Studia Geobot. 7, suppl. 1: 126 - 127 (1987).

Type: SWEDEN: [no locality, no date], leg. Ch. Stenhammar (FRIES, Lich. Exs. Suec. no. 405, UPS!, isotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: areolate, up to 40 mm diam., 0.1 - 0.2 mm thick.

AREOLES: angular to irregularly shaped, brown to dark brown, plane to subconvex, with smooth surface, c. 0.3 - 0.5 mm, max. 0.5 - 1 mm diam. Cortex 20 - 30 μ m thick; upper cell layer brown; hyphae c. 3 - 3.5 μ m diam.; epinecral layer 10 - 85 μ m thick. Algal layer c. 80 - 100 μ m thick; algal cells c. 9 μ m, max. 12 μ m diam. Medulla I -; hyphae 3.5 - 4 μ m thick.

HYPOTHALLUS: black, well developed, obvious between the areoles and at the thallus margin.

Apothecia: round to roundish, dispersed to crowded, 8 - 25/cm², sessile, not constricted at the base, or subimmersed, c. 0.4 - 0.9 mm, max. 0.6 - 1.5 mm diam. Disc plane, black, matt, epruinose. Margin at first distinct, persistent or vanishing, black, matt.

EXCIPULUM: max. 40 - 70 μ m, lateral of hymenium 40 - 65 μ m thick. Ectal zone green-black; pigmented zone 8 - 15 μ m thick; hyphae 3.5 - 5 μ m diam., with lumina of 1.2 - 1.5 μ m. Inner zone grey (due to lichen substances); hyphae 3 - 5.5 μ m diam., with lumina of 1 - 1.5 μ m. Medullary zone mostly developed at the basal part.

HYPOTHECIUM: colourless; hyphae 3 - 4 μ m diam.; subhymenial layer colourless.

HYMENIUM: 50 - 60 μ m tall, colourless, I $\pm$ blue, Iconc.-. Epihymenium black to olivaceous, 10 - 13 μ m tall. Paraphyses branched, mostly not anastomosing, 1.5 - 2 μ m, apical 3 μ m thick. Asci c. 35 - 40 x 10 - 12 μ m; tholus max. 8 - 11 μ m, min. 3.5 - 6 μ m thick; outer amyloid wall layer c. 0.5 μ m thick, I+ brown, Iconc.+ red-brown; non-amyloid wall layer not obvious; masse axiale up to 3 μ m broad; amyloid zone above masse axiale not developed. Spores ellipsoid, 8 - 11 x 4 - 4.5 (- 5.5) μ m.

Pycnidia: immersed. Conidia filiform, curved, c. 25 - 35 x 0.8 - 1 μ m.

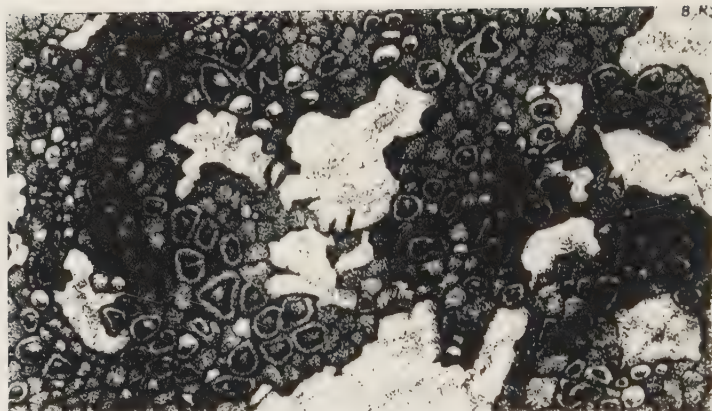


Fig. 11. *Miriquidica deusta*. (HH 31690, M) Scale = 1 mm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

3 chemotypes observed:

- a) containing miriquidic acid (1 specimen examined);
- b) containing lobaric acid (1 specimen examined);
- c) containing miriquidic acid, lobaric acid, norstictic acid (2 specimens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! The species is known from northern Europe (VAINIO 1934, SANTESSON 1984), central and southern Europe (CLAUZADE & ROUX 1985, NIMIS & POELT 1987). AHTI & al. (1973) report it ("cf.") from Canada (N.W.T.). Within Australia *M. deusta* has been found in the alpine zone of the Snowy Mountains (N.S.W.) and in the Brindabella Range (A.C.T.), growing on siliceous rock in exposed positions (map 17).

NOTES:

M. deusta is characterized by a brown thallus, areoles with a well developed epinecral layer, a conspicuous hypothallus, subimmersed apothecia, and a colourless hypothecium. *Miriquidica complanata* (Koerb.) Hertel & Rambold and *M. instrata* (Nyl.) Hertel & Rambold, which are only known from the Northern Hemisphere and which also show subimmersed to immersed apothecia, are morphologically similar. These two species, however, constantly contain miriquidic acid and typically have a less developed epinecral layer and hypothallus.



Map 17. Distribution of *Miriquidica deusta* in continental Australia

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3483, 3484 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31690 (M).

A.C.T.: Bimberi Peak, 35°40'S, 148°48'E, 1800 - 1880 m, 20.x.1981, leg. V.Wirth 11174 (STU).

Miriquidica leucophaea (Flk. ex Rabenh.) Hertel & Rambold

HERTEL & RAMBOLD, Mitt. Bot. Staatssamml. München 23: 386 - 387 (1987).

≡ *Biatora leucophaea* Flk. ex Flot., Die merkwürdigen und seltenen Flechten des Hirschberg-Warmbrunner Thals und des Hochgebirgs: 14 (1839) - nomen nudum!

≡ *Biatora leucophaea* Flk. ex Rabenh., Deutschl. Krypt.-Fl. 2: 91 - 92 (1845).

≡ *Lecidea leucophaea* (Flk. ex Rabenh.) Nyl., Flora 53: 35 (1870); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 789 - 790 no. 7110 (1925); 8: 373 (1932); SANTESSON, Lich. Sweden Norway: 168 (1984).

Type: POLEN: "Hhst [= (?) Hochstein, Schlesien], 25.vii.1845", [leg. J. v. Flotow (?) - ex herb. Sommerfelt] (O, lectotype - designated in HERTEL & RAMBOLD 1987).

DESCRIPTION:

Thallus: dispersed areolate, up to 30 - 40 mm diam., 0,1 - 0,2 mm thick.

AREOLES: roundish, pale grey, subconvex, with smooth surface, c. 0.4 mm, max. 0.6 mm diam. Cortex c. 10 - 15 µm thick; upper cell layer brown-grey due to incrustated lichen substances, not pigmented; hyphae c. 3 µm diam.; epinecral layer c. 5 µm thick. Algal layer c. 70 µm thick; algal cells c. 10 µm, max. 12 µm diam. Medulla I -; hyphae 3.5 µm thick.

HYPOTHALLUS: black, obvious between the areoles.

Apothecia: roundish, crowded to dispersed, c. 50/cm², sessile, constricted at the base, c. 0.5 mm, max. 0.6 mm diam. Disc plane, black, subnitid, epruinose. Margin well developed and persistent, black, nitid. **EXCIPULUM:** max. 60 - 70 µm, lateral of hymenium 50 - 60 µm thick.

Ectal zone dark grey-green; pigmented zone c. 10 µm thick; hyphae 4 - 5 µm diam., with lumina of c. 1 µm. Inner zone greyish; hyphae c. 3 µm diam., with lumina of c. 1 µm. Medullary zone well developed.

HYPOTHECIUM: colourless; hyphae 3 - 4 µm diam.; subhymenial layer colourless.

HYMENIUM: 55 - 65 µm tall, colourless, I± blue, Iconc. -. Epihymenium dark olivaceous, c. 10 µm tall. Paraphyses more or less branched and anastomosing, 1.8 - 2 µm, apical up to 5 µm thick. Asci c. 35 x 12 µm; tholus max. 8 - 10 µm, min. 5 - 6 µm thick; outer amyloid wall layer c. 0.5 µm thick, I+ brown, Iconc. + brown; non-amyloid wall layer c. 0.7 µm thick; amyloid zone above masse axiale not obvious. Spores ellipsoid, 10 - 12.5 x 4 - 5.5 µm.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing miriquidic acid (1 specimen examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! This species is widely distributed in Europe and probably occurs in the whole holarctic region. It grows on siliceous rocks in the alpine zone as well as at lower altitudes. In Australia, only one specimen of *M. leucophaea* has been collected in the Kosciusko area (map 18).

NOTES:

M. leucophaea is a rather polymorphic species. It is characterized by a pale grey to creamy thallus colour, sessile apothecia, a colourless hypothecium, an olivaceous epihymenium, and the presence of miriquidic acid. It is easily distinguished from *Miriquidica deusta*, which shows nitid brown areoles, subimmersed apothecia and a well developed hypothallus. In Europe, the delimitation of *M. leucophaea* from *M. complanata* and *M. griseoatra*, occasionally causes difficulties.



Map 18. Distribution of *Miriquidica leucophaea* in continental Australia

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3738 (M).

Protoparmelia Choisy

CHOISY, Bull. Soc. Bot. France **76**: 522 - 523 (1929); HAFELLNER, Beih. Nova Hedwigia **79**: 292 (1984); HERTEL, Beih. Nova Hedwigia **79**: 451 - 452 (1984).

Typus generis: *Lecanora badia* (Hoffm.) Ach. [= *P. badia* (Hoffm.) Hafellner] - (holotype).

The monotypic genus *Protoparmelia* was re-established by HAFELLNER (1984). HERTEL (1984) recognized *Lecidea petraeoides* as a leci-deoid member of this originally lecanoroid genus. HAFELLNER in CLAUZADE & ROUX (1985) included *Lecanora picea* (Dicks.) Nyl., and POELT & NIMIS in NIMIS & POELT (1987) included *Lecanora montagnei* (Fr.) Schaer. into *Protoparmelia*. SANTESSON & WIRTH in WIRTH (1987), recognized *Lecanora atriseda* (Fr.) Nyl., and JØRGENSEN, RAMBOLD & HERTEL in HERTEL (1988) the corticolous *Lecanora ochrococca* (Nyl.) Clauz. & Roux to belong to this genus.

The species of *Protoparmelia* anatomically are rather similar to each other aside from the development of the excipulum. However striking differences have been observed in length and shape of the conidia.

Table 7. The main characters of the saxicolous species of *Miriquidica* and *Protoparmelia* occurring in Australia:

1.) Adnation of apothecia; 2.) margination of apothecia; 3.) average breadth of spores [μ m]; 3.) colour of the thallus; 4.) height of epinecral layer [μ m]; 5.) length of conidia [μ m]; 6.) development and colour of hypothallus; 7.) chemistry.

[biat = biatorine; bl = black; cr = creamy; gre = grey; lecan = lecanorine; lob = lobaric acid; mir = miriquidic acid; baeomy = baeomycesic acid (and additional substances), nors = norstictic acid; se = sessile; si = subimmersed].

	Apoth. adn.	Apoth. marg.	Spore br.	Thallus colour	Epin. layer	Conidia length	Hyp. th.	Chemistry
<i>M. deusta</i>	si	biat	4-5,5	cr	10-85	25-35	bl	lob/mir
<i>M. leucophaea</i>	se	biat	4-5,5	gre/cr	c. 5	?	-	mir
<i>P. badia</i>	se	lecan	3.5-4.5	cr	c. 10	6-9	-	lob
<i>P. petraeoides</i>	se/si	biat	3-4(-5)	gre/cr	5-15	14-17	gre	nors
<i>P. plicatula</i>	se	biat	3-4	cr	5-15	15-23	-	baeomy

The lecanoroid species *P. atriseda*, and the lecideoid *P. petraeoides* and *P. plicatula* show filiform, curved and elongated conidia (up to c. 30 μm in *P. atriseda*), similar to those in *Miriquidica*, while in the lecanoroid type species *P. badia* and in *P. montagnei* they are cylindrical and relatively short (c. 6 - 10 μm). The pycnidia of *P. ochrococca* and *P. picea* have yet to be observed.

Protoparmelia is closely related to *Miriquidica* and is distinguished mostly by ascus characters and the reddish-brown epihymenial pigmentation. For further delimiting characteristics of *Miriquidica* see HERTEL & RAMBOLD (1987: 379 - 380) and RAMBOLD & SCHWAB (in press).

Protoparmelia badia (Hoffm.) Hafellner

HAFELLNER, Beih. Nova Hedwigia 79: 292 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 121 (1986); NIMIS & POELT, Studia Geobot. 7, suppl. 1: 188 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 17, 157 (1988).

≡ *Verrucaria badia* Hoffm., Flecht. Deutschl.: 182 (1796).

≡ *Lichen badius* (Hoffm.) Ach., Lichenogr. Suec. Prodr.: 67 (1798).

≡ *Lecanora badia* (Hoffm.) Ach., Lichenogr. Univ.: 407 (1810); ZAHLBRUCKNER, Catal. Lich. Univ. 5: 393 - 396 no. 10193 (1928); HERTEL, Willdenowia 6: 235 (1971); MAKAREVICZ, Opredel. Lischajn. USSR: 82 - 83 (1971); FILSON, Checklist Austr. Lich. 1. ed.: 41 (1983); SANTESON, Lich. Sweden Norway: 141 (1984).

≡ *Solenopsora badia* (Hoffm.) Choisy & R.G.Werner, Bull. Soc. Hist. Natur. Afrique 22: 11 (1931) [n.v.].

Type: GERMANY: [n.v.] - "In hircyniam ad saxum trapesium (Trapp suecis)" (vide protologue).

DESCRIPTION:

Thallus: rimose, verrucose to areolate, up to 50 mm diam., up to 1.6 mm thick.

AREOLES: irregularly shaped, brown to pale brown, subconvex to convex, with smooth to rough surface, c. 0.6 - 0.7 mm, max. 1 - 1.5 mm diam. Cortex 20 - 30 μm thick; upper cell layer brown pigmented; hyphae c. 5 - 6 μm diam.; epinecral layer c. 10 μm thick. Algal layer c. 90 μm thick; algal cells c. 9 - 10 μm , max. 10 - 12 μm diam. Medulla I -; hyphae c. 5 μm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, mostly crowded, 15 - 60/cm², sessile, constricted at the base, c. 0.9 - 1.2 mm, max. 2.0 - 3.0 mm diam. Disc subconvex to convex, brown to dark brown, nitid, epruinose. Margin at first distinct and persistent, pale brownish, nitid.

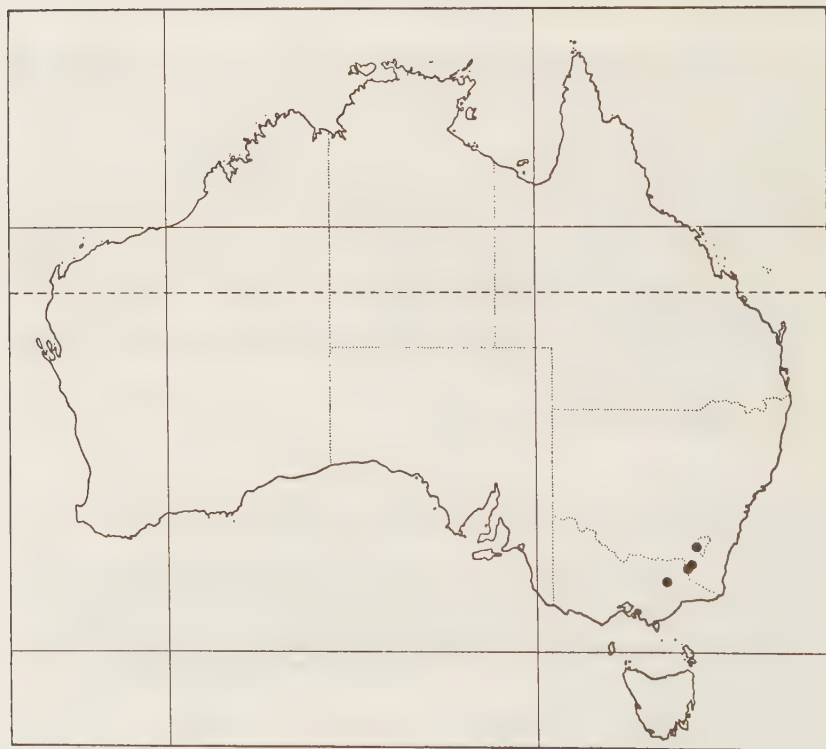
EXCIPULUM: max. and lateral of hymenium 140 - 200 μm thick. Ectal zone brown; pigmented zone 10 - 15 μm thick; hyphae c. 6 - 7 μm diam., with lumina of 1 - 2.5 μm . Inner zone colourless, incrustated with

lichen substances; hyphae c. 5 μm diam., with lumina of 2 - 2.5 μm . Medullary zone well developed.

HYPOTHECIUM: colourless; hyphae 3.5 - 5 μm diam.; subhymenial layer colourless.

HYMENIUM: 60 - 80 μm tall, colourless, I $\pm$ blue, Iconc.-. Epihymenium brown, c. 15 μm tall. Paraphyses branched, rarely anastomosing, 2 - 2.5 μm , apical 5 - 6 μm thick. Asci c. 35 - 60 x 13 - 16 μm ; tholus max. 10 - 13 μm , min. 2 - 3 μm thick; outer amyloid wall layer 0.2 - 0.3 μm thick, I $\pm$ blue-brown, Iconc. $\pm$ brown; non-amyloid wall layer c. 1.0 μm thick; masse axiale 2.5 - 5 μm broad, amyloid zone above masse axiale not obvious. Spores oblong-ellipsoid, 10 - 12 x 3.5 - 4.5 μm .

Pycnidia: immersed. Conidia cylindrical, 6 - 7.4 - 9 x 0.8 - 1.2 μm .



Map 19. Distribution of *Protoparmelia badia* in continental Australia

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing lobaric acid and associated substances (4 specimens examined).

DISTRIBUTION:

Bipolar. *P. badia* has a worldwide distribution, occurring in the mountainous and alpine zone. Within continental Australia, it has been found in the Snowy Mountains (N.S.W.), in the Brindabella Range (A.C.T.) and in Vic., growing on siliceous rock in exposed position (map 19).

NOTES:

P. badia is included in this study, although it is a lecanoroid species. Aside from the different type of margination, the species is distinguished from the two other saxicolous Australian representatives of *Protoparmelia* by the length of the conidia and by its chemistry (tab. 7).

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, summit of Round Mtn, 28 km NE of Khancoban, 36°17'S, 148°35'E, 1750 m, 10.iv.1985, leg. J.A.Elix 19068 (ANUC); -- Kosciusko National Park, Blue Lake 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G. Rambold 3432 (M); -- Kosciusko National Park, 2 km NW of Charlottes Pass, [36°26'S, 148°18'E], 1920 m, 5.xii.1979, leg. J.A.Elix 6518 (ANUC); Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake, 1720 m, 14.i.1986, leg. G.Rambold 3461, 3462 (M); -- Kosciusko National Park, Mt Guthrie 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3496 (M); -- Kosciusko National Park, just S of Rawsons Pass, [36°28'S, 148°16'E], 2130 m, 9.ii.1978, leg. J.A.Elix 4252 (ANUC).

A.C.T.: Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m, 21.i.1984, leg. J.A.Elix 11630 (ANUC); -- Ginini Flats, Brindabella Range, 1540 m, 28.iii.1979, leg. J.A.Elix 5904 (ANUC).

Victoria: Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3026 (M).

Protoparmelia petraeoides (Nyl. ex Bab. & Mitt.) Hertel

HERTEL, Beih. Nova Hedwigia 79: 452 (1984); Mitt. Bot. Staatssamml. München 21: 330 - 332 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 120 (1986); NIMIS & POELT, Studia Geobot. 7, suppl. 1: 190 (1987); HERTEL & RAMBOLD, Mitt. Bot. Staatssamml. München 23: 380 - 381 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 157 (1988).

= *Lecidea petraeoides* Nyl., Enum. Gen. Lich.: 125 (1857) [Mem. Soc. Sci. Nat. Cherbourg 5: 125 (1858)] - nomen nudum!

- = *Lecidea petraeoides* Nyl. ex Bab. & Mitt. in Hooker, Fl. Tasman. 2: 352, tab. CC, fig. D* (1859) - [according to ICBN art. 44 the drawings can be regarded as an original description]; MÜLLER, Fragm. Phytogeogr. Austr. 11, suppl.: 117 (1880); HUE, Nouv. Arch. Mus. Paris, ser. 3, 3: 134 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 667 no. 6640 (1925); WETMORE, Rev. Bryol. Lichenol. 32: 241 (1963); FILSON, Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 126 (1986).

Type: AUSTRALIA: Tasmania: [no locality or date or collector], (BM!, holotype; H-Nyl. 5803 p.p., 12.065!, isotypes).

- = *Lecidea aspidula* Kremp.

KREMPELHUBER, Verh. K. K. Zool.-Bot. Ges. Wien 30: 341 (1880); KREMPELHUBER in MÜLLER, Fragm. Phytogeogr. Austr. 11, suppl.: 73 (1880); KNIGHT in BAILEY, Synopsis Queensl. Fl.: 750 (1883); MÜLLER ARGOVIENSIS, Flora 70: 60, 61, 118 (1887); Nuovo Giorn. Bot. Ital. 23: 391 (1891); Bull. Herb. Boissier 1 (2): 45 (1893); 3 (12): 640 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 734 - 735 no. 6897 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1972); HERTEL, Mitt. Bot. Staatssamml. München 18: 446 (1982); ELIX & STREIMANN, Journ. Hattori Bot. Lab. 51: 78 (1982); FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); HERTEL, Beih. Nova Hedwigia 79: 452 (1984) pro syn.; FILSON, Austr. Fl. Fauna Ser. 4: 112 (1986).

Type: AUSTRALIA: Queensland: Rockhampton, [no date], leg. A. Thozet (M!, holotype, MEL 7002!, isotype).

- = *Lecidea diaphaenenta* Knight **syn. nov.**

KNIGHT, Trans. Linn. Soc. London ser. 2, 2: 46 - 47 (1882); WILSON, Proc. Roy. Soc. Queensl. 6 (2+3): 92 (1889); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 755 no. 6986 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 115 (1986); FILSON, Checklist Austr. Lich. 3. ed.: 19, 102 (1988).

Type: AUSTRALIA: New South Wales: neighbourhood of Sydney, [no date], leg. Ch. Knight (vol. 48A, p. 2, no. 35): "*L. diaphonenta*" (WELT!, holotype; H-Nyl. 21331!, isotype = type of *Lecidea pelophaea* Nyl.).

- = *Lecidea enteroxantha* Knight **syn. nov.**

KNIGHT, Trans. Linn. Soc. London ser. 2, 2: 46, tab. VIII, fig. 30 c (1882); WILSON, Proc. Roy. Soc. Queensl. 6 (2+3): 92 (1889); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 756 no. 7001 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 115 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).

Type: AUSTRALIA: New South Wales: [vide KNIGHT 1882: neighbourhood of Sydney], [no date], leg. Ch. Knight (WELT (vol. 200, p. 30 no. 29)!, holotype).

= *Lecidea pelophaea* Nyl. nomen illegit.! [ICBN art. 63.1]

NYLANDER, Flora 69: 324-325 (1886); HUE, Nouv. Arch. Mus. Paris, ser. 3, 3: 127 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 665 no. 6630 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 53 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 126 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988).

Type: AUSTRALIA: New South Wales: [neighbourhood of Sydney], 1880, leg. Ch. Knight (H-Nyl. 21331!, holotype = isotype of *Lecidea diaphaenenta* Knight).

DESCRIPTION:

Thallus: verrucose-areolate, up to 80 mm diam., 0.2 - 1.2 (- 3) mm thick.

AREOLES: irregularly roundish to angular, creamy white to dark brown, irregularly convex, with mostly smooth surface, c. 0.3 - 0.8 (- 1.5) mm, max. 0.6 - 3.0 mm diam. Cortex 10 - 20 μ m thick; upper cell layer brown; hyphae c. (2 -) 3 - 4.5 μ m diam.; epinecral layer 5 - 15 μ m thick. Algal layer c. (40 -) 60 - 90 μ m thick; algal cells c. 8 - 10 μ m, max. 11 - 12 μ m diam. Medulla I -; hyphae 2.5 - 3 μ m thick.

HYPOTHALLUS: dark grey-brown, obvious at the thallus margin, mostly not developed.

Apothecia: irregular roundish, crowded to dispersed, up to 250/cm², (sub-)immersed to sessile and not constricted at the base, c. 0.5 - 0.8 mm, max. 0.5 - 1.3 mm diam. Disc plane to subconvex, red-brown to dark brown, nitid, epruinose. Margin at first obvious, later persistent or vanishing, red-brown, nitid.

EXCIPULUM: max. 50 - 100 μ m, lateral of hymenium 30 - 70 μ m thick. Ectal zone colourless to pale brown; pigmented zone 10 - 20 μ m thick; hyphae 3 - 6 μ m diam., with lumina of 1 - 1.2 μ m. Inner zone pale brown to colourless; hyphae 2.5 - 3 μ m diam., with lumina of c. 1 - 1.5 μ m. Medullary zone not obvious.

HYPOTHECIUM: colourless; hyphae 2.5 - 3 μ m diam.; subhymenial layer colourless.

HYMENIUM: 35 - 55 μ m tall, colourless, I $\pm$ blue, Iconc.-. Epihymenium brown to red-brown, 10 - 15 μ m tall. Paraphyses branched and anastomosing, c. 1.5 μ m, apices 2.5 - 3.5 μ m thick. Asci c. 30 - 45 x 10 - 12 μ m; tholus max. c. 10 μ m, min. 2 - 2.5 μ m thick; amyloid zone above masse axiale not obvious; outer amyloid wall layer 0.1 μ m thick, I-, Iconc. $\pm$ brown; non-amyloid wall layer c. 1 μ m thick. Spores ellipsoid-oblong, 8.5 - 11 x 3 - 5 μ m.

Pycnidia: immersed. Conidia filiform, 14 - 15.5 - 17 x 0.5 μ m.

CHEMISTRY:

Cortex K+ red, C-, P $\pm$ yellow; medulla K+ red, C-, P $\pm$ yellow; excipulum K+ red, C-, P $\pm$ yellow.

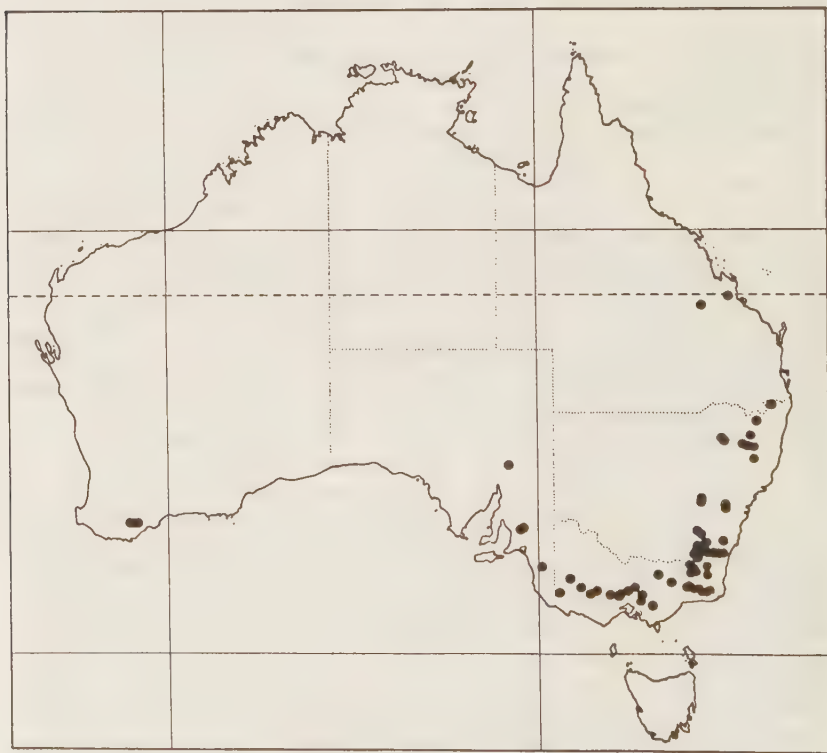
One chemotype observed, containing norstictic acid (major), connorstictic acid (c. 170 specimens examined).

DISTRIBUTION:

Xeric. *P. petraeoides* was reported for the South Island of New Zealand (HERTEL 1985: 331, fig. 9) and for Australia incl. Tasmania (WEBER & WETMORE 1972: 51, HERTEL 1984: 452). Meanwhile, the species has been found in South Africa (HAIDUK unpubl.) and in Sardinia in the Northern Hemisphere (NIMIS & POELT 1987: 190). In continental Australia, the species occurs in W.A., S.A., Qld, N.S.W., A.C.T and Vic. (map 20), growing on exposed siliceous rock under warm to cool temperate conditions.

NOTES:

P. petraeoides is a very polymorphic species, developing thalli with highly varying colour, ranging from pale grey to dark red-brown. The species is also quite variable concerning the adnation of the apothecia, which can be subimmersed or sessile.



Map 20. Distribution of *Protoparmelia petraeoides* in continental Australia

Anatomically and chemically *P. petraeoides* is very uniform. Another lecideoid representative of *Protoparmelia* is *P. plicatula*, which probably is an Australian endemic and constantly contains baeomycesic acid as the major substance. Both species have rather narrow spores with a breadth of 3 - 4 (- 5) μm .

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 43 ("*Lecidea aspidula*") (M)

HERTEL, Lecideac. Exs. no. 194, 195 ("*Protoparmelia petraeoides*") (M)

WEBER, Lich. Exs. no. 273 ("*Lecidea aspidula*" (AD, CANB, HO, M)

SPECIMENS EXAMINED:

Western Australia: Stirling Range National Park, Mt Hassell, 34°23'S, 118°04'E, sandstone rocks on summit, c. 848 m, 2.iv.1986, leg. G.Rambold 5383 (M); -- Stirling Range National Park, Bluff Knoll, 34°23'S, 118°15'E, exposed sandstone outcrops on peak SW of summit, c. 1000 m, 3.iv.1986, leg. G.Rambold 5394, 5407, 5414 (HERTEL, Lecideac. Exs. no. 195, M); -- Stirling Range National Park, Toolbrunup Peak, [34°24'S, 117°58'E], 19.iv.1980, leg. D.H.S.Richardson 178 (PERTH); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, leg. G. Rambold 5319, 5357, 5359, 5367 (M).

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G.Rambold 5508, 5513, 5524 (M); -- Guthries Stepp Gully, 9 km E of Springton, [34°42'S, 139°04'E], 400 m, 12.viii.1981, leg. M. & H.Mayrhofer 2782 (GZU); -- Fred Rattel's Scrub, 7 km W of Springton, 34°44'S, 139°17'E, 500 - 530 m, 12.viii.1981, leg. M. & H.Mayrhofer 2808 (GZU); -- Mt Lofty, on quartzose rock, 12.ix.1889, leg. F.R.M.Wilson (NSW 155880); -- Mt Monster Conservation Park, 12 km S of Keith on Dukes Highway, 36°12'S, 140°19'E, 15.viii.1981, leg. M. & H.Mayrhofer 2983 (GZU); -- 4 km W of Carey Gully along the Forest Range road, 456 m, 21.xii.1976, leg. J.A.Elix 2816 (ANUC, MEL).

Queensland: Rockhampton, [23°22'S, 150°30'E], [no date], leg. A.Thozet (holotype of *Lecidea aspidula* Kremp., M); -- Blackdown Tableland National Park, Rainbow Fall Lookout, 23°51'S, 149°06'E, outcrops of sandstone, c. 600 m, 14.ii.1986, leg. G.Rambold 4493, 4495, 4496, 4507, 4508 (M).

New South Wales: Moonbi Range, 9 km NE of Tamworth, 28°30'S, 152°45'E, dry sclerophyll forest, on granite, 450 m, 12.i.1980, leg. H. Streimann 9808 (CBG, H, M, US); -- Bolivia Hill, 11 km NNE of Deepwater, 29°20'S, 151°57'E, dry sclerophyll forest, 930 m, 23.i.1980, leg. H.Streimann 9952 (CBG); -- Ben Lomond, 40 km S of Glen Innes, [30°01'S, 151°40'E], 1400 m, 18.viii.1976, leg. J.A.Elix 2436 (ANUC); -- Mt Kaputar National Park, "The Gins", 30°07'S, 150°04'E, 1100 m, 13.vii.1986, leg. P.Merrotsey 321 (BRIU); -- Mt Kaputar National Park, summit of Mt Kaputar, 30°16'S, 150°10'E, 1500 m, 8.ii.1987, leg. P.Merrotsey 465 (BRIU); -- Mt Kaputar National Park, W of Kaputar Rocks, 30°17'S, 150°09'E, 1450 m, 8.ii.1987, leg. P.Merrotsey 457, 460, 461 (BRIU); -- Mt Kaputar National Park, at Repeater Station near Kaputar Rocks Lookout, 30°17'S, 150°09'E, 1450 m, 8.ii.1987, leg. P.Merrotsey 437, 447 (BRIU); -- New England, Armidale Distr., 35 km NW of Armidale, Parlour Mountain Area, [30°25'S, 151°17'E], c. 1000 m, 11.x.1981, leg. H.Mayrhofer 3478 (GZU); -- Granite boulders 1 mi N of Uralla, 30°30'S, 151°30'E, 3000 ft, vi.1960, leg. H.Perich (COLO S-26556, CANB); -- 20 km E of Armidale along the Dorrigo road, [30°33'S, 151°50'E], on granite rocks, 1018 m, 17.viii.1976, leg. J.A.Elix 2412 (ANUC); -- Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4289 (M); -- Mt Canobolas, 8 km SW of Orange, 33°19'S, 149°00'E, 1390 m, 8.viii.1979,

leg. H.Streimann 9242 (CBG, H); -- Summit of Mt Canobolas, 8 km SW of Orange, [33°21'S, 148°59'E], on volcanic rock on open summit, 1426 m, 8.viii.1979, leg. J.A.Elix 6244 (ANUC); -- Du Fours Lookout, 1.5 km W of Mount Wilson, 33°30'S, 150°22'E, westerly exposed sandstone outcrops, 960 m, 2.ii.1986, leg. G.Rambold 4178 (M); -- Mt Victoria, [33°35'S, 150°15'E], on rocks, xii.1900, leg. E.Cheel (NSW 155757, 155757); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S facing outcrops of sandstone, 905 m, 1.ii.1986, leg. G.Rambold 4115 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, SE facing sandstone rock walls beside Dardanelles Pass Walking Track, 760 - 900 m, 1.ii.1986, leg. G.Rambold 4135 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing sandstone cliffs between "The Three Sisters" and "Echo Point", 920 m, 1.ii.1986, leg. G.Rambold 4149 (M); -- Teudts Hill, 5 km SW of Bundanoon, [34°39'S, 150°18'E], on sandstone rocks in open *Eucalyptus* forest, 680 m, 17.ix.1980, leg. J.A.Elix 8971 (ANUC); -- 1 km NW of Binalong, 34°40'S, 148°38'E, sparse *Eucalyptus* forest, on rocky side of gentle ridge, 490 m, 17.xi.1979, leg. H.Streimann 9522 (CBG, COLO, H, M, NICH, US); -- Blackburn Road, 14 km NNE of Yass, 34°47'S, 148°59'E, *Eucalyptus* dominated grasslands, 700 m, 1.x.1984, leg. H.Streimann 31368 (CBG); -- Braidwood District, Pigeon House, Range between Nerriga and Sassafras, [35°05'S, 150°10'E], 1.x.1967, leg. W.A.Weber & D.McVean (COLO L-49035); -- Blue Range 7 km N of Condor Creek, c. 25 km W of Canberra, [35°20'S, 148°50'E], c. 800 m, 1.ix.1981, leg. H.Mayrhofer 3154, 3156 (GZU); -- Braidwood District, SE of Rossi, wet sclerophyll forest remnant, on forest boulder, 19.xii.1967, leg. W.A.Weber & D.McVean (COLO L-49310); -- Brindabella Ranges, Mt Franklin, near Chalet, 38 km SW of Canberra, 35°30'S, 148°46'E, 1500 m, 14.ii.1978, leg. D.Verdon 3334 (CBG, M); -- Murrumbidgee River, The Long Plain, 47 km NNW of Adaminaby, 35°37'S, 148°36'E, *Eucalyptus pauciflora* dominated grasslands, 1450 m, 11.i.1979, leg. H.Streimann 7462 (CBG, M); -- Southern Tablelands, Merricumbene Fire Trail, 11 km S of Monga, 35°40'S, 150°04'E, on ridge top, c. 800 m, 4.iv.1976, leg. D.Verdon 2213 (CBG); -- Tinderry Mountains, 1 km E of Allen Creek and 3 km E of Michelago Peak - North Tinderry Peak, 35°40'S, 149°13'E, c. 850 m, 15.v.1976, leg. D.Verdon 2284 (CBG); -- Head of Mongarlowe River, 27 km SE of Braidwood, 35°41'S, 149°54'E, large steep rock outcrop, 1000 m, 21.xi.1979, leg. D.Verdon 4627 (CBG); -- Gourcock Range, along Cowangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G.Rambold 3970, 3976 (M); -- Tinderry Range, Tinderry Peak, c. 12 km E of Michelago on the Captains Flat Road, 35°44'S, 146°19'E, 1600 m, 8.xii.1977, leg. D.Verdon 3192 (CBG); -- Tinderry Range, southern foothills of Tinderry Peak on road to Captains Flat, 10 km ESE of Michelago, 35°45'S, 149°16'E, 28.ix.1978, leg. D.Verdon 3696 (CBG); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3911 3916 (M); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3748 (M); -- 14 km N of Adaminaby on Yaouk Road, 35°52'S, 148°47'E, creek bank in hilly terrain, c. 1130 m, 18.viii.1975, leg. D.Verdon 1729A (CBG); -- Southern Tablelands, Bradley's Creek flowing out of the Yaouk Bill Range, 35°53'S, 148°53'E, moderately sloping rocky creek bank, 1240 m, 18.viii.1975, leg. D.Verdon 1742 (CBG); -- Kosciusko National Park, summit of Mt Jagungal, [36°09'S, 148°23'E], 6764 ft, 16.iii.1967, leg. R.Filson 10222 (MEL); -- 15 km E of Cooma along Numeralla road, [36°12'S, 149°15'E], on rocks in dry sclerophyll forest, 912 m, 19.i.1976, leg. J.A.Elix 1496, 1497 (ANUC); -- Cooma, 1 km NNW of town, 36°13'S, 149°08'E, low outcrops on slope, in open low *Eucalyptus* woodland beside road to Rosedale, 850 m, 19.i.1986, leg. G.Rambold 3677 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G.Rambold 3645 (M); -- Co-

ma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G.Rambold 3702 (M); -- Wildflower Reserve, Cooma North, [36°14'S, 149°08'], 2.v.1974, leg. J.H.Willis (MEL 515745); -- Kosciusko National Park, Snowy River Valley near Island Bend, 36°20'S, 148°28'E, 1260 - 1280 m, 3.iii.1985, leg. H.Hertel 31880, 31887 (M); -- Kosciusko National Park, Diggers Creek, 24 km E of Mt Kosciusko, 36°21'S, 148°29'E, 1500 m, 9.ii.1978, leg. D.Verdon 3303 (CBG); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3628, 3640 (M); -- Kosciusko National Park, along Diggers Creek, 1.5 km S of Island Bend, [36°22'S, 148°29'E], on granite rocks, 9.ii.1978, leg. J.A.Elix 4380 (MEL); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, 1620 - 1680 m, 3.iii.1985, leg. H.Hertel 31827 (M); -- Lake Jindabyne, small unnamed peninsula between mouth of Thredbo River and the Jindabyne, 36°24'S, 148°37'E, 950 m, 3.iii.1985, leg. H.Hertel 32058 (M); -- Kosciusko National Park, Spencers Creek, 2 km E of Charlottes Pass, 36°25'S, 148°21'E, in *Eucalyptus pauciflora* woodland, on granite rocks, 1800 m, 23.i.1984, leg. J.A.Elix 11673 (ANUC); -- West bank of Lake Jindabyne, 2.5 km NW of Jindabyne, 36°25'S, 148°36'E, granitic boulders in pasture land beside road to Charlottes Pass, c. 900 m, 13.i.1986, leg. G.Rambold 3379 3380 3395 (M); -- Kosciusko National Park, near summit of Mt Guthrie, [36°26'S, 148°20'E], on sheltered granite rocks 1920 m, 9.ii.1978, leg. J.A.Elix 4356 (ANUC); -- Kosciusko National Park, northern slopes of Mt Stilwell, 36°26'S, 148°19'E, 1900 - 2000 m, 23.i.1984, leg. P.W.James (BM); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3490, 3492, 3498 3511 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, N exposed vertical and overhanging rock wall beside track, 2000 m, 17.i.1986, leg. G.Rambold 3603 (M); -- Kosciusko National Park, Charlottes Pass, 9 km from Mt Kosciusko towards Perisher Valley, 36°27'S, 148°20'E, 1840 m, 9.ii.1978, leg. D.Verdon 3275 (CBG); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31670 (M); -- Southern Tablelands, Steeple Flat, 10 km SE of Nimmitabel, 36°32'S, 149°21'E, valley flat, swampy area, 1100 m, 16.vii.1975, leg. D.Verdon 1442 (CBG); -- 28 km SSW of Jindabyne, near Ingebyra, 36°39'S, 148°30'E, big and small granitic boulders in pasture land beside Buchan - Jindabyne road, c. 950 m, 13.i.1986, leg. G.Rambold 3367 (M); -- Bondi State Forest, 45 km S of Bombala along the Cann Valley, [37°15'S, 149°17'E], on granite rocks in dry sclerophyll forest, 23.xi.1978, leg. J.A.Elix 5411 (ANUC); -- Hornsby, ix.1897, leg. F.R.M.Wilson (NSW 180236); -- [no locality, no date], leg. Ch.Knight 35 (type of *Lecidea diaphanota* Knight, WELT); -- [no locality], 1880, leg. Ch.Knight (type of *Lecidea pelophaea* Nyl., H-Nyl.); -- [no locality, no date], leg. Ch.Knight (type of *Blatora enteroxantha* Knight, WELT).

A.C.T.: Smoker's Gap, [35°11'S, 148°54'E], on granite rocks in forest, 1247 m, 13.i.1975, leg. J.A.Elix 510 (ANUC, MEL); -- Kowen Forest, [35°15'S, 149°16'E], on sandstone rocks, 730 m, 21.ii.1975, leg. J.A.Elix 1327 (ANUC, CANB); -- Mt Ainslie, Canberra, [35°17'S, 149°13'E], low outcrops in dry sclerophyll forest, 2000 ft, 30.ix.1967, leg. W.A.Weber & D.McVean (COLO L-47384); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, exposed summit on rhyolite rocks, 1420 m, 18.xii.1985, leg. J.A.Elix 19763 (ANUC); -- Blue Range, 24 km WNW of Canberra, 35°18'S, 149°51'E, semi-closed *Eucalyptus* forest on easterly facing gully, 1100 m, 25.iv.1980, leg. H. Streimann 10191 (CBG, H, M, US); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, rhyolite rocks, 1420 m, 27.i.1986, leg. G.Rambold 4066 (M); -- Brindabella Range W of Canberra, below the summit of Mt Coree, [35°19'S, 148°49'E], 5000 ft, 11.x.1967, leg. W.A.Weber & D.McVean (COLO L-49222); -- Molonglo Gorge Reserve, 16 km E of Canberra, [35°20'S, 149°20'E], in dry sclerophyll forest, on rocks, 650 m, 21.v.1981, leg. J.A.Elix 9036 (ANUC); --

Mt Jerrabomberra near Queanbeyan, [35°21'S, 149°14'E], on summit boulders, 30.ix.1967, leg. W.A.Weber (COLO L-47379); -- Brindabella Range, Mt Franklin Road, 31.5 km SW of Canberra, 35°23'S, 148°48'E, roadside cutting, schistose rock, c. 1220 m, 12.iii.1975, leg. D.Verdon 1011 (CBG, NICH); -- Brindabella Range, west face of Mt Aggie, [35°28'S, 148°46'E], on exposed schistose rocks, 1480 m, 28.iii.1979, leg. J.A.Elix 5865 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, [35°28'S, 148°46'E], at exposed summit, on sheltered schist rocks, 1490 m, 14.xi.1981, leg. J.A.Elix 9521, 9526 (ANUC); -- Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°48'E, exposed schistose slate outcrops, 1480 - 1490 m, 19.x.1981, leg. V.Wirth 11036, 11054, 11058, 11107, 11173, 14077 (STU); -- Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schist rock outcrops, 1490 m, 21.i.1984, leg. P.W.James (BM); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4012, 4016, 4027, 4033, 4035, 4037, 4045, 4049, 4056 (M); -- 36 km SW of Canberra, Mt Aggie, 35°29'S, 148°45'E, vertical exposed rock face, 1480 m, 28.vii.1980, leg. D.Verdon 1481 (CBG, NICH); -- 36 km SW of Canberra, Mt Aggie, 35°29'S, 148°45'E, 1480 m, 23.vii.1975, leg. D.Verdon 1482A (CBG); -- 45 km SW of Canberra, 0.5 km S of Gibraltar Falls, 35°29'S, 148°57'E, 1150 m, 17.x.1981, leg. V.Wirth 10590, 10777 (STU); -- Brindabella Range, summit of Mt Franklin, 45 km WSW of Canberra, [35°29'S, 148°47'E], subalpine heath on exposed schist rocks, 1644 m, 29.v.1982, leg. J.A.Elix 10259 (ANUC); -- Near summit of Mt Franklin, above road to Mt Ginini, [35°30'S, 148°45'E], 1585 m, 26.ii.1975, leg. J.A.Elix 607 (ANUC, CANB); -- Brindabella Range W of Canberra, along the crest of Brindabella Range near Mt Ginini, open *Eucalyptus pauciflora* forest, 14.xii.1967, leg. W.A.Weber & D.McVean (WEBER, Lich. Exs. no. 273, AD, CANB, HO, M); -- Brindabella Range, Ginini Flats, [35°30'S, 148°45'E], on granite rocks in open subalpine forest, 1540 m, 28.iii.1979, leg. J.A.Elix 5905 (ANUC); -- Near Gingera, 35°34'S, 148°48'E, xii.1967, leg. D.McVean 67229 (CBG); -- Gudgenby River Gorge, 4.5 km S of Tharwa, [35°35'S, 149°00'E], in open woodland on granite rocks, 660 m, 17.x.1981, leg. J.A.Elix 9151 (ANUC); -- Booroomba Rocks, 11 km SW of Tharwa, [35°35'S, 149°00'E], on exposed granite rocks in alpine heath, 1360 m, 11.vii.1979, leg. J.A.Elix 6129, 6135 (ANUC); -- Bimberi Peak, Bimberi Range, 49 km SW of Canberra, 35°40'S, 148°48'E, *Eucalyptus pauciflora* forest, 1700 m, 11.xii.1979, leg. H.Streimann 9706 (CBG, M), 9740 (HERTEL, Lecideac. Exs. no. 43, M); -- 4.5 km S of Tharwa, Gudgenby River Gorge, 35°45'S, 145°58'E, 660 m, 17.x.1981, leg. V.Wirth 10310 (STU); -- Naas Creek, 57 km S of Canberra, 35°49'S, 148°56'E, on rocky creek bank, 1677 m, 18.viii.1975, leg. D.Verdon 1682A (CBG, NICH); -- Naas Creek, 57 km S of Canberra, 35°49'S, 148°56'E, on rocky creek bank, 1160 m, 18.viii.1975, leg. D.Verdon 1662 (CBG); -- Mt Clear, Clear Range, 64 km S of Canberra, 35°53'S, 158°05'E, *Eucalyptus pauciflora* forest on gentle slope, 1590 m, 1.x.1980, leg. H.Streimann 10588 (CBG).

Victoria: Beechworth, [36°22'S, 146°42'E], 1892, leg. F.R.M.Wilson (NSW 155876); -- Mt Arapiles, [36°45'S, 141°50'E], 10.x.1894, leg. F.M.Reader (MEL 7003); -- Bogong High Plains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, 1610 m, 26.ii.1985, leg. H. Hertel 31413, 31453 (M); -- Great Dividing Range, Mt. Wombargo, near Rocky Plains, 36°56'S, 148°12'E, rock flow in *Eucalyptus pauciflora* forest, 1400 m, 27.ii.1985, leg. H.Hertel 31522 (HERTEL, Lecideac. Exs. no. 194); -- East Gippsland, 2 km NE of Suggan Buggan, [36°57'S, 148°20'E], on sheltered granite rocks, 600 m, 21.ix.1978, leg. J.A.Elix 5000 (ANUC); -- Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3311, 3313, 3325, 3332 (M); -- Highlands, 8 km N of Yea, 37°07'S, 145°25'E, 580 m, 19.iv.1981, leg. H. Streimann 15502, 15502A (CBG, H, M, US); -- Grampian Mtns, [37°08'S, 142°26'E], [no date], leg. D.Sullivan (NSW 155874); -- The Grampian Mtns, [37°08'S, 142°26'E], 22.v.1963, leg. S.L.Thrower 838 (BM); -- The Grampians, Halls Gap, [37°09'S, 142°31'E], 1945, leg.

P.Bibby (MEL 1018501); -- Strawberry Gully, 70 km NE of Orbost, Bonang Highway, 37°09'S, 148°44'E, dry sclerophyll forest, 700 m, 4.iv.1980, leg. H.Streimann 10004 (CBG, M); -- 16 km SE of Wulgulmerang, 37°09'S, 148°25'E, small boulders in tall open *Eucalyptus* forest along Deddick Track (S of Bowen Track), 800 - 900 m, 12.i.1986, leg. G.Rambold 3361 (M); -- Roadside Stop, Mt Cole State Forest, 25 km E of Ararat, 37°14'S, 143°14'E, 19.viii.1981, leg. M.& H.Mayrhofer 2984 (GZU); -- Gippsland, Bandi State Forest, along Cann River Valley Highway 45 km S of Bombala, 37°15'S, 149°15'E, montane moderate slope, 360 m, 23.xi.1978, leg. D.Verdon 4352 (CBG); -- Errinundra Flora Reserve, Goonmirk Rocks, 14 km S of Bendoc, 37°17'S, 148°53'E, 1200 m, 10.iv.1986, leg. J.A.Elix 19953 (ANUC); -- Kilmore, [37°18'S, 144°57'E], on rock, 31.viii.1885, leg. F.R.M.Wilson (NSW 155881); -- Western Grampians, Victoria Range, Castle Rock, [37°20'S, 141°15'E], on sandstone rock surface, c. 2000 ft, 11.xii.1966, leg. J.H.Willis (MEL 1018449); -- Mt Ararat, [37°20'S, 142°52'E], [no date, no collector] (NSW 155878); -- Mt Macedon, [37°23'S, 144°37'E], 9.v.1885, leg. F.R.M.Wilson (NSW 155883); -- Mt Macedon, 37°23'S, 144°37'E, on rock, iv.1886, leg. F.R.M. Wilson (NSW 155879); -- "Three Sisters", Three Sisters Track, 23 km NNE of Cann River, 37°23'S, 149°06'E, dry sclerophyll forest, 920 m, 27.ix.1985, leg. J.A.Elix 19534 (ANUC); -- "Three Sisters", Three Sisters Track, 23 km NNE of Cann River, 37°23'S, 149°06'E, dry sclerophyll forest, 920 m, 27.ix.1985, leg. J.A.Elix 19541, 19535 (ANUC); -- Kingston, [37°23'S, 143°58'E], basaltic rock, 11.v.1897, leg. F.R.M.Wilson (NSW L3611); -- Buxton, Cathedral Range, Sugarloaf Peak, 37°24'S, 145°45'E, *Eucalyptus* forest, 11.x.1981, leg. V.Wirth 10746, 10761, 10957, 10960 (STU); -- Cockpit, Macedon, [37°25'S, 144°34'E], 26.i.1900, leg. R.A.Bastow 63 (COLO, MEL); -- Melbourne, Mt Donna Buang, [37°42'S, 145°40'E], iii.1963, leg. P.W.James (BM, 2 specimens); -- Hanging Rock, on boulders, xi.1961, leg. S.L.Thrower HR 4 (COLO L-37012); -- Baw Baw National Park, Mt Erica, 37°52'S, 146°22'E, big granite boulders "Mushroom Rock" in *Acacia* dominated forest (between carpark and summit), 1200 m, 9.i.1986, leg. G.Rambold 3199 (M); -- SW Victoria, [no locality], x.1963, leg. G.Beaton 365 (BM); -- Beaconsfield, Stony Creek, [no date], leg. F.R.M.Wilson (NSW 155875, 155877, 155936); -- Yaryangs, on granite rock, 3.xi.1885, leg. F.R.M. Wilson (NSW 155882).

***Protoparmelia plicatula* (Müll.Arg.) Rambold comb. nov.**

≡ *Psora plicatula* Müll.Arg., Bull. Herb. Boissier 1: 35 (1893); FILSON, Austr. Fl. Fauna Ser. 4: 249 (1986).

≡ *Lecidea plicatula* (Müll.Arg.) Zahlbr., Catal. Lich. Univ. 3: 889 no. 7432 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); SCHNEIDER, Biblioth. Lich. 13: 245 (1980); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); Checklist Austr. Lich. 2. ed.: 63 (1986); Austr. Fl. Fauna Ser. 4: 127 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988).

Type: AUSTRALIA: Victoria: Melbourne, Kew, [comm.] 1892, F.R.M. Wilson 339 (G!, holotype; G, isotype [coll. 1891]) - [containing baeomycesic acid (major), squamatic acid, barbatic acid (minor, traces)].

DESCRIPTION:

Thallus: verrucose-areolate, up to 120 mm diam., 0.3 - 1.8 mm thick.

AREOLES: irregularly roundish, creamy to pale brown, irregularly convex, with smooth surface, c. 0.4 - 1.2 mm, max. 0.8 - 3.0 mm diam. Cortex 10 - 30 μ m thick; upper cell layer pale grey to colourless; hyphae c. 2.5 - 4 μ m diam.; epinecral layer 5 - 15 μ m thick. Algal layer c. 50 - 80 μ m thick; algal cells c. 9 - 11 μ m, max. 12 - 15 μ m diam. Medulla I -; hyphae 3.5 - 4 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: irregularly roundish to auriculate, dispersed to crowded, 10 - 75/cm², sessile, mostly not constricted at the base, c. 0.5 - 1.2 mm, max. 0.9 - 1.8 (- 3) mm diam. Disc plane to convex, black-brown, nitid, epruinose. Margin at first mostly obvious, later more or less persistent, creamy to black-brown, nitid to subnitid.

EXCIPULUM: max. 60 - 150 μ m, lateral of hymenium 55 - 100 μ m thick. Ectal zone colourless to brown; pigmented zone 10 - 12 μ m thick; hyphae 3 - 5 μ m diam., with lumina of 1 - 2.5 μ m. Inner zone colourless to faint brown; hyphae 3 - 4 μ m diam., with lumina of 1 - 2 μ m. Medullary zone not developed.

HYPOTHECIUM: colourless, incrustated with lichen substances; hyphae 2 - 4 μ m diam.; subhymenial layer colourless.

HYMENIUM: 35 - 45 μ m tall, colourless to weakly tinged brown, I+ blue, Iconc.-. Epihymenium brown, 10 - 20 μ m tall. Paraphyses more or less branched and anastomosing, 1.5 - 2 μ m, apices 2.5 - 3.5 μ m thick. Asci c. 30 - 40 x 8 - 11.5 μ m; tholus max. 9 - 12 μ m, min. 2 - 3 μ m thick; amyloid zone above masse axiale c. 0.5 - 1.0 μ m thick; outer amyloid wall layer 0.2 μ m thick, I-, Iconc. -; non-amyloid wall layer 0.5 - 1.0 μ m thick. Spores ellipsoid-oblong, 7 - 12 x 3 - 4 μ m.

Pycnidia: immersed. Conidia filiform, 15 - 18 - 22 x c. 0.8 μ m.

CHEMISTRY:

Cortex K $\pm$ yellowish, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing baeomycesic acid (major), squamatic acid, barbatic acid (minor, traces) (24 specimens examined).

DISTRIBUTION:

Endemic. *P. plicatula* was hitherto known only from the type collection. The species is restricted to the temperate regions in the south east of the continent, growing on siliceous rock, particularly in open forest areas (map 21).

NOTES:

The species can easily be recognized by its extraordinary chemistry. The β -orcinol para-depsides baeomycesic acid, squamatic acid and barbatic acid are not known to occur in any other lecideoid species. For further discussions see notes under *P. petraeoides*.

SPECIMENS EXAMINED:

South Australia: Mt Lofty Ranges, Mt Crawford, on rocks in dry sclerophyll forest, 562 m, 2.ix.1977, leg. J.A.Elix 3836 (ANUC); -- Mt Lofty Ranges, summit of Mt Crawford, 562 m, 7.ix.1979, leg. J.A.Elix 6391 (ANUC); -- Summit of Mt Barker, 32 km SE of Adelaide, 35°04'S, 138°55'E, 11.viii.1981, leg. M.& H.Mayrhofer 2776 (GZU).

Queensland: Blackdown Tableland National Park, Rainbow Fall Lookout, 23°51'S, 149°06'E, outcrops of sandstone, c. 600 m, 14.ii.1986, leg. G.Rambold 4510, 4516 (M).

New South Wales: Barrington Tops National Park, Gloucester Tops, Negrohead Beech Forest Walking Trail, on way to Gloucester Falls, 32°05'S, 151°35'E, c. 1200 m, 4.ii.1986, leg. G.Rambold 4260 (M); -- Du Fours Lookout, 1.5 km W of Mount Wilson, 33°30'S, 150°22'E, westerly exposed sandstone outcrops, 960 m, 2.ii.1986, leg. G.Rambold 4173, 4176, 4177 (M); -- Berowra, [33°38'S, 151°09'E], ix.1897, leg. F.R.M.Wilson (NSW 180034); -- Great Dividing Range, 12.6 km E of Bungendore, [35°15'S, 149°38'E], on sandstone rocks in dry sclerophyll forest, 850



Map 21. Distribution of *Protoparmelia plicatula* in continental Australia

m, 23.iii.1977, leg. J.A.Elix 2975 (ANUC, MEL); -- Central Tablelands, Fitzroy Falls, 16 km SE of Moss Vale, 35°38'S, 150°28'E, 753 m, 26.viii.1977, leg. D.Verdon 3036 (CBG); -- Gourock Range, along Co-wangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G.Rambold 3978, 3980 (M); -- Tinderry Mountains, 10 km ESE of Michelago, 35°45'S, 149°18'E, dry sclerophyll forest on gentle westerly slope, 1250 m, 15.xi.1981, leg. H.Streimann 15827a-c (M); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3908, 3919 (M); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, rocky outcrops with *Leptospermum* in *Eucalyptus* woodland, 1250 m, 9.ix.1987, leg. H.T.Lumbsch (hb. Lumbsch, M) -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G.Rambold 3651 (M); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G.Rambold 3692, 3694 (M).
Victoria: Mt Macedon, [37°23'S, 144°37'E], 9.v.1885, leg. F.R.M.Wilson (MEL 7146); -- 8 km W of Melton, 1 km N of Anthony's cutting, on the Djerriwarrah creek, [37°42'S, 144°31'E], open *Eucalyptus* forest, 100 m, 10.x.1981, leg. V.Wirth 10974 (STU); -- Melbourne, Mt Donna Buang, [37°42'S, 145°41'E], iii.1963, leg. P.W.James (BM); -- Melbourne, Kew, [37°49'S, 144°58'E], on sandstone rock, 1892, leg. F.R.M.Wilson 339 (type of *Psora plicatula* Müll.Arg., G).

Pyrrhospora Koerb.

KOERBER, Syst. Lich. Germaniae: 209 (1855); POELT, VEZDA & JAMES in POELT & VEZDA, Biblioth. Lich. 16: 263 - 264 (1981); HAFELLNER, Beih. Nova Hedwigia 79: 298 (1984).

Typus generis: *Pyrrhospora quercea* (Dicks.) Koerb. - (holotype).

The genus *Pyrrhospora* was regarded as synonym to *Lecidea* and *Protoblastenia* for a long time but was re-introduced by CHOISY (1950), who's system was not accepted until 1980/1981, when HAWKSWORTH & al. (1980) and POELT & VEZDA (1981) started to use KOERBER's name. HAFELLNER (1984) placed it into the family Lecanoraceae s.str. *Pyrrhospora* comprises saxicolous as well as corticolous and lignicolous species. Aside from the lecanoroid tholus, the genus is characterized by red to black-brown apothecia, simple, non-halonate spores, and filiform conidia.

***Pyrrhospora sanguinolenta* (Kremp.) Rambold & Hafellner comb. nov.**

= *Calloposma sanguinolentum* Kremp., Verh. K. K. Zool.-Bot. Ges. Wien 26: 449 - 500 (1877); KREMPELHUBER in MÜLLER, Fragm. Phytogeogr. Austr. 11, suppl.: 98 (1880); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 824 (1925) - sub *Lecidea russula*; WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972) - sub *L. russula*; FILSON, Checklist Austr. Lich. 1. ed.: 15 (1983); Checklist Austr. Lich. 2. ed.: 19 (1986); Austr. Fl. Fauna Ser. 4: 48 (1986).

Type: AUSTRALIA: "New England [no date, leg. (?) Ch. Knight], comm. F.v.Müller" (M!, lectotype - designated here).

[- non: *Lecidea sanguinolenta* Stirt. in Bailey, Queensl. Agric. J. 5: 488 (1899).]

DESCRIPTION:

Thallus: areolate to rimose, up to 70 mm diam., 0.3 - 0.5 mm thick.

AREOLES: irregularly shaped to angular, pale creamy yellowish, plane, with mostly rough surface, c. 0.5 - 0.7 mm, max. 0.9 - 1.4 mm diam. Cortex c. 30 µm thick; upper cell layer not pigmented; hyphae c. 3.5 µm diam.; epinecral layer not developed. Algal layer c. 70 µm thick; algal cells c. 9 µm, max. 10 µm diam. Medulla I -; hyphae c. 3 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish to auriculate, dispersed to crowded, 15 - 40/cm², more or less constricted at the base, c. 0.9 - 1.5 mm, max. 1.4 - 2.1 mm diam. Disc plane to convex, red, mostly nitid, epruinose. Margin at first distinct, later vanishing or persistent, red, nitid.

EXCIPULUM: max. 100 - 160 µm, lateral of hymenium 80 - 100 µm thick. Ectal zone red to colourless; pigmented zone diffuse; hyphae 3.5 - 6 µm diam., with lumina of c. 1.5 µm. Inner zone red to colourless; hyphae 3 - 4 µm diam., with lumina of 1 - 1.5 µm. Medullary zone not developed.

HYPOTHECIUM: pale brown, 200 - 300 µm thick; hyphae 3 - 3.5 µm diam.; subhymenial layer pale brown to colourless.

HYMENIUM: 35 - 45 µm tall, colourless to red-brown, I+ blue, Iconc. ± blue. Epihymenium orange-red, 12 - 15 µm tall. Paraphyses usually not branched and anastomosing, 1.8 - 2 µm, apical c. 3 µm thick. Asci c. 35 - 40 x 8 - 9 µm; tholus max. 7 - 9 µm, min. 2 - 4 µm thick; outer amyloid wall layer c. 0.2 µm thick, I+ blue, Iconc. ± blue; non-amyloid wall layer not obvious; masse axiale c. 3.5 µm broad; amyloid zone above masse axiale not obvious. Spores ellipsoid, c. 8 - 9 x 3 - 4.5 µm.

Pycnidia: immersed. Conidia filiform, curved, 20 - 25 x 0.8 - 1 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K+ red, C-, P+ yellow; excipulum K+ red, C-, P-.

One chemotype observed, containing norstictic acid, connorstictic acid, lichexanthone and an unknown pigment (11 specimens examined).

DISTRIBUTION:

Australasian? This species is known from New Zealand and continental Australia, where it occurs in Qld and N.S.W., growing on exposed siliceous rock at lower altitudes (map 22).

NOTES:

P. sanguinolenta is the only saxicolous member of *Pyrrhospora* hitherto found in Australasia and cannot be mistaken for any other lecidoid lichen species in this region. It shows no chemical and only little anatomical and morphological variation. The world distribution of this species will remain unclear until the genus as a whole is better known.

According to HAFELLNER (in litt.), the Northern Hemisphere species including the type species *P. quernei*, contain anthraquinones and chlorine containing xanthones. They probably are somewhat isolated from the "*Lecidea russula* - group", to which *P. sanguinolenta* belongs. In the latter, as affirmed by LEUCKERT (in litt.), anthraquinones and chlorine containing xanthones do not occur. Preliminarily, the two species groups are generically unified.

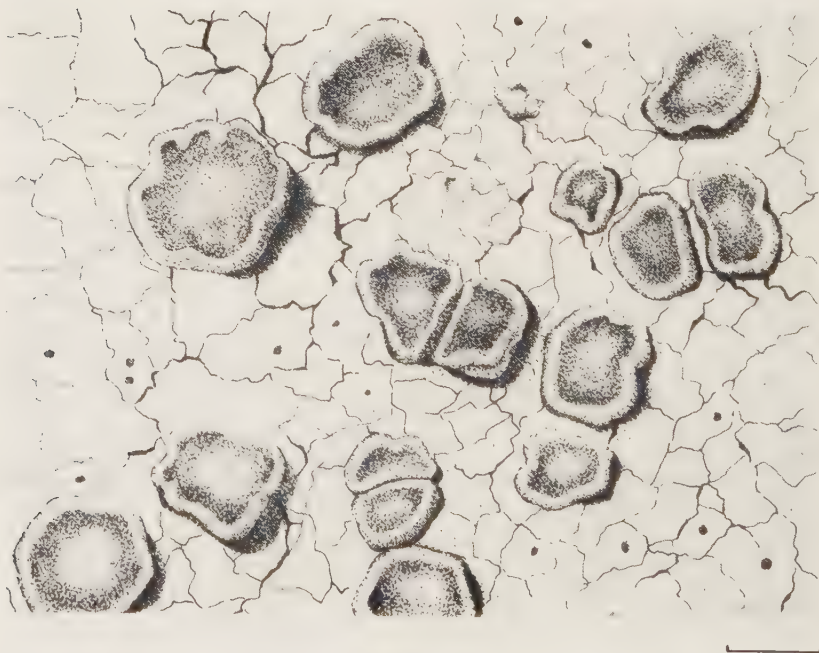
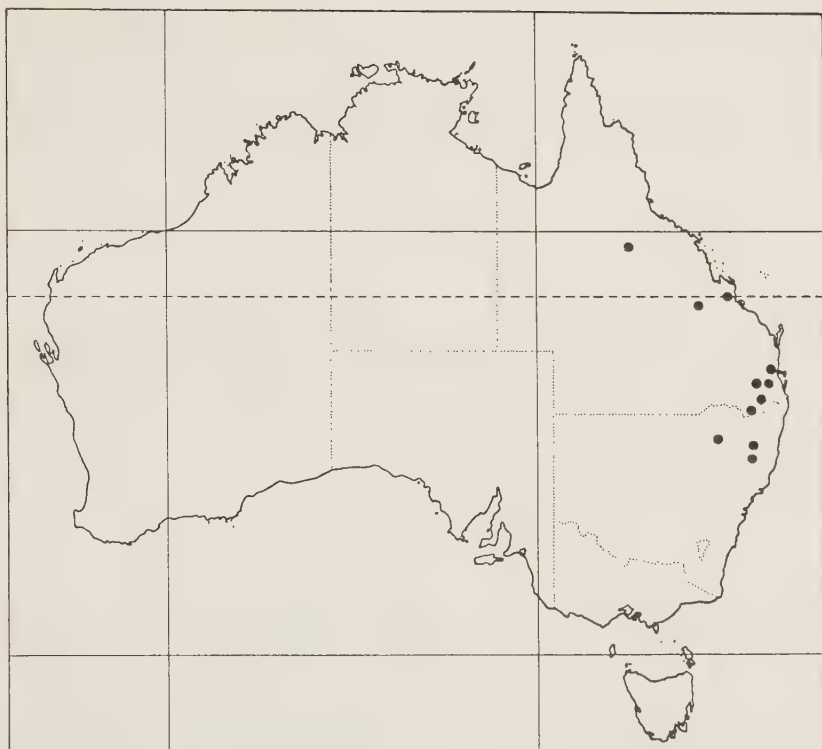


Fig. 12. *Pyrrhospora sanguinolenta*. (GR 4460, M) Scale = 1 mm.



Map 22. Distribution of *Pyrrhospora sanguinolenta* in continental Australia

SPECIMENS EXAMINED:

Queensland: Hughenden - Townsville Hwy, 28 km SW of Pentland, 20°43'S, 145°14'E, 460 m, 26.vi.1986, leg. J.A.Elix 20756, 20766 (ANUC); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, vertical and overhanging surface of E exposed rocky outcrops, 480 m, 13.ii.1986, leg. G.Rambold 4460 (M); -- Blackdown Tableland National Park, Stony Creek Lookout, 23°47'S, 149°00'E, outcrops of sandstone, c. 720 m, 15.ii.1986, leg. G.Rambold 4523, 4530 (M); -- Blackdown Tableland National Park, Rainbow Fall Lookout, 23°51'S, 149°06'E, outcrops of sandstone, c. 600 m, 14.ii.1986, leg. G.Rambold 4518 (Hertel, Lecideac. Exs. in prep.); -- Glasshouse Mtns, [26°54'S, 152°57'E], [no date], leg. F.M.Bailey (BRI 354972); -- Brisbane Forest Park, NW of Brisbane, c. 12, 5 km NW Enoggera Reservoir, granodiorite boulders in open *Eucalyptus* forest, 27°25'S, 152°51'E, c. 400 m, 1.viii.1986, leg. J.Hafellner 15817 (hb. J.Hafellner, Plantae Graec. Exs. in prep.); -- Helidon, [27°33'S, 152°08'E], [no date], leg. J.Shirley (BRI 354969); -- Brisbane area, Mistake Mtns, c. 50 km E of Warwick, 28°19'S, 152°23'E, 29.ix.1987, leg. H.T.Lumbsch 5709 k (hb. Lumbsch); -- 15 km S of Stanthorpe along Hwy 15, [28°47'S, 151°51'E], 910 m, 2.ix.1976, leg. J.A.Elix 2670 (ANUC).

New South Wales: Mt Kaputar National Park, Spring Creek, near the caves, 30°11'S, 150°03'E, 700 m, 14.iii.1987, leg. P.Merrotzky 403 (BRIU); -- 20 km E of Armidale along Dorrigo Road, 30°31'S, 151°55'E, 1018 m, 17.viii.1976, leg. J.A.Elix 2408 (ANUC); -- 20 km E of Armidale along the Dorrigo Road, 30°31'S, 151°55'E, 1018 m, 17.viii.1976, leg. J.A.Elix 2404, 2421 (ANUC); -- Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4288 (M); -- Mt Wheelers, [no date], leg. A.Thozet (M).

Tephromela Choisy

CHOISY, Bull. Soc. Bot. France **76**: 522 (1929); HAFELLNER, Beih. Nova Hedwigia **79**: 344 (1984); HERTEL, Beih. Nova Hedwigia **79**: 456 (1984).

Typus generis: *Lecanora atra* (Huds.) Ach. (holotype) [= *Tephromela atra* (Huds.) Hafellner] - (holotype).

= *Heppsonia* Awasthi & Singh **syn. nov.**

AWASTHI & SINGH, Bryologist **80**: 536 - 538 (1977); HAFELLNER, Beih. Nova Hedwigia **79**: 291 (1984).

Typus generis: *H. indica* Awasthi & Singh - (holotype).

The genus *Tephromela* was re-established by HAFELLNER in KALB (1983) for *Lecanora atra*. This species, *Lecanora grumosa* (Pers.) Du Rietz [= *T. grumosa* (Pers.) Hafellner & Roux] and *Lecanora pertusarioides* Degel. [= *T. pertusarioides* (Degel.) Hafellner & Roux], were already regarded to represent a distinct genus by EIGLER (1969) and POELT & VEZDA (1981). The genus concept of *Tephromela* was enlarged by HERTEL (1984), who included the lecideoid species *Lecidea eatoni* Cromb. [= *T. eatoni* (Cromb.) Hertel] and by HERTEL & RAMBOLD (1985), who included *Lecidea aglaea* Sommerf. [= *T. aglaea* (Sommerf.) Hertel & Rambold], *L. armeniaca* (DC.) Fr., and *L. testaceoatra* Vain. [= *T. testaceoatra* (Vain.) Hertel & Rambold], which were already recognized to represent a separate unit within *Lecidea* s.l. by MAGNUSSON (1931). Their inclusion into *Tephromela* was not accepted by CLAUZADE & ROUX (1987: 199), who regard this group as a separate genus. In their discussion of this problem, however, these authors unfortunately didn't give any satisfying explanation for their point of view.

In this study, the close relationship of *T. atra* and the lecideoid species of *Tephromela* could be underlined by the following observations: 1.) The lecanoroid species *T. arafurensis*, described from North Australia, shows close affinities to *T. atra* in its anatomical and morphological characters, but has a more or less colourless to pale violet-brown hymenium, similar to the lecideoid members of this genus. 2.) Within the Australian material of *T. atra*, several lecideoid specimens have been found. It is not obvious, however, whether these modifications are genetically determined or have been induced by environmental factors, e.g. by the inclination of the substratum. The absence of the thalline margin does not seem to have been caused by

grazing damage of invertebrates either. 3.) Some specimens of *T. atra* contain bourgeanic acid, a fatty acid, which is also known from *T. aglaea* (tab. 8).

HAFELLNER (1984: 292, fig. 38) regarded the genus *Heppsora* to be a member of the Lecanoraceae because of its ascus structures. Now, this genus must be recognized as a synonym of *Tephromela*, because both genera are based on one and the same species [*H. indica* = *T. atra*]. This also indicates the high variability of the form of the masse axiale within the tholus of the Lecanoraceae (= Tephromelataceae).

	Hymenium		Margination			Chemistry	
	viol.	colourl.	red.	blat.	lecan.	atr.	fatty acids
<i>T. arafurensis</i>	+	+	-	-	+	+	± unknown f. ac.
<i>T. atra</i>	+	-	+	+	+	+	± bourgeanic ac.
<i>T. aglaea</i> *	-	+	+	+	-	+	± bourgeanic ac.
<i>T. armeniaca</i>	-	+	+	+	-	+	± roccellic ac.

Table 8. Some important diagnostic characters of the Australian and one extra-Australian species (*) of *Tephromela*: a) hymenium violet or colourless; b) margin of the apothecia reduced, biatorine or lecanorine; c) thallus containing atranorin, fatty acids (additional lichen substances are omitted).

Tephromela arafurensis Rambold sp. nov.

DIAGNOSIS:

Tephromelae atrae similis, hymenio minus colorato et thallo acidum perlaticum, acidum glomellifericum, acidum anziacum et ex parte acidum lipidicum incognitum continente differt.

Type: AUSTRALIA: Northern Territory: Robin Falls, 13 km SSE of Adelaide River, 13°21'S, 131°08'E, sandstone boulders beside creek, in monsoon forest, 80 m, 24.iii.1986, leg. G. Rambold 5127 (M, holotype) — [containing atranorin, perlatic acid, glomelliferic acid, anziaic acid (tr)].

DESCRIPTION:

Thallus: rimose, up to 50 mm diam., 0.2 - 0.5 mm thick.

AREOLES: irregularly shaped, white to weakly tinged pale green, plane to subconvex, with rough surface, c. 0.5 - 0.7 mm, max. 1.0 - 1.7 mm diam. Cortex 10 - 15 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer not developed. Algal layer c. 35 - 65 µm thick; algal cells c. 8 - 9 µm, max. 9 - 11 µm diam. Medulla I-; hyphae 3 - 3.5 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed, $10 - 24/\text{cm}^2$, sessile, more or less constricted at the base, c. $0.8 - 0.9$ mm, max. $0.8 - 1.4$ mm diam. Disc plane to subconvex, black, nitid to subnitid, epruinose. Margin mostly developed and more or less persistent, white, matt.

EXCIPULUM: thalline, max. $40 - 85$ μm , lateral of hymenium $40 - 70$ μm thick, rarely reduced. Ectal zone colourless; pigmented zone c. 20 μm thick; hyphae c. 4 μm diam., with lumina of c. $1.2 - 1.5$ μm . Inner zone colourless; hyphae c. 3 μm diam., with lumina of c. 1.2 μm . Medullary zone well developed.

HYPOTHECIUM: pale yellow-brown, colourless, $150 - 300$ μm thick; hyphae $4 - 5.5$ μm diam.; subhymenial layer colourless, pale yellow-brown, $50 - 150$ μm thick.

HYMENIUM: $55 - 65$ μm tall, colourless to weakly tinged violet-brown, $I \pm$ blue, $I_{\text{conc.}}$ -. Epihymenium dark violet-brown, $10 - 15$ μm tall. Paraphyses branched and anastomosing, $3 - 5$ μm , apical $4.5 - 6$ μm thick. Asci c. $60 - 65 \times 9 - 10$ μm ; tholus max. $7 - 14$ μm , min. $6 - 11$ μm thick; outer amyloid wall layer c. $0.5 - 1$ μm thick, $I \pm$ brownish, $I_{\text{conc.}}$ + brown; non-amyloid wall layer c. $0.5 - 1$ μm thick; masse axiale c. 1.5 μm broad, convergent, amyloid zone above masse axiale $1 - 7$ μm tall. Spores ellipsoid, $9 - 14 \times 5 - 7$ μm .

Pycnidia: immersed. Conidia cylindrical, $11 - 14 \times 1 - 1.5$ μm .

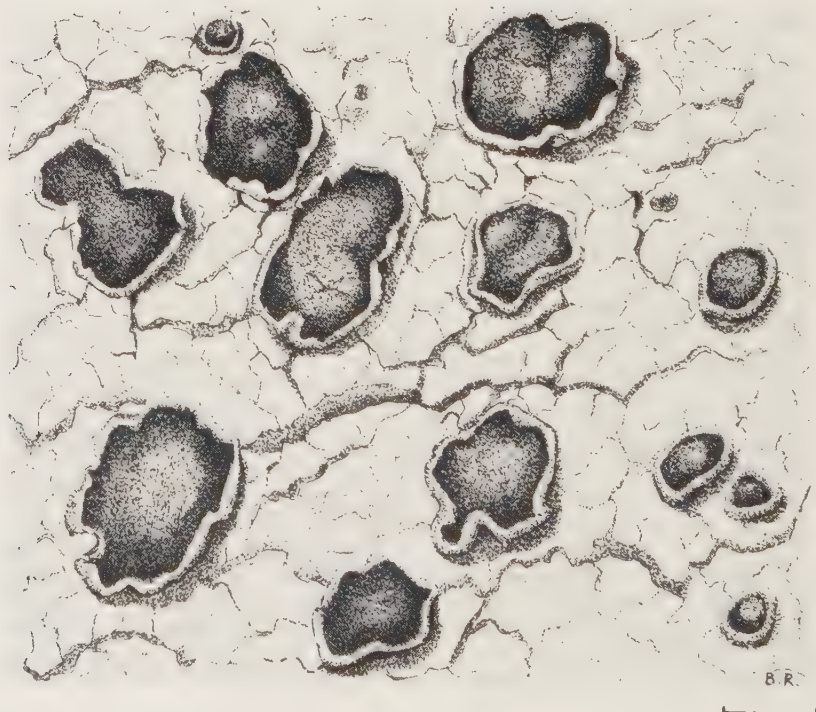


Fig. 13. *Tephromela arafurensis*. (GR 5223, M) Scale = 1 mm.



Map 23. Distribution of *Tephromela arafurensis* in continental Australia

CHEMISTRY:

Cortex K+ yellow, C-, P± yellow; medulla K-, C-, P-; excipulum K-, C-, P-.

Two chemotypes observed:

- a) containing atranorin, perlatolic acid, glomelliferic acid, anziaic acid (minor);
 - b) containing an additional unknown fatty acid;
- (totally 18 specimens examined).

DISTRIBUTION:

Endemic ? (or western pacific or palaeotropical). *T. arafurensis* is restricted to northern Australia (W.A., N.T.) (map 23), growing on siliceous rock in sheltered position in open grassland and open forests.

NOTES:

This species is well characterized by a colourless to pale violet-brown hymenium, by its chemistry and lecanorine apothecia. It is closely related to *T. atra*, which, however, has a much wider ecological range and distribution and does not occur together with *T. arafurensis*. The specific epithet refers to the Arafura Sea N of Australia.

SPECIMENS EXAMINED:

Western Australia: Hidden Valley National Park, 1.5 km NE of Kununurra, 15°46'S, 128°45'E, S facing sandstone cliffs near carpark, 80 m, 29.iii.1986, leg. G.Rambold 5261 (M); -- 3 km E of Kununurra, 15°47'S, 128°45'E, 70 m, 10.v.1988, leg. J.A. Elix 22101 (ANUC); -- Kununurra, 2.5 km SE of town, 15°48'S, 128°46'E, W facing sandstone cliffs beside Duncan Highway, 60 m, 29.iii.1986, leg. G.Rambold 5218, 5222, 5223, 5226, 5231, 5244 (M); -- King Leopold Range, gorge 3 km NW of Silent Grove, 63 km NE of the Lennard River crossing, along the Gibb River road, 17°06'S, 125°24'E, 350 m, 16.v.1988, leg. J.A.Elix 22253, 22260 (ANUC); -- Erskine Range, Great Northern Hwy, between Derby and Fitzroy Crossing, 17°51'S, 124°20'E, 120 m, 18.v.1988, leg. J.A.Elix 22335 (ANUC).

Northern Territory: Robin Falls, 13 km SSE of Adelaide River, 13°21'S, 131°08'E, sandstone boulders beside creek, in monsoon forest, 80 m, 24.iii.1986, leg. G. Rambold 5127 (type of *T. arafurensis*, M); -- Stuart Hwy, Hayes Creek, 40 km NW of Pine Creek, 13°38'S, 131°35'E, 200 m, 8.v.1988, leg. J.A.Elix 22058 (ANUC); -- 25 km NE of Katherine, Butterfly Gorge, 14°19'S, 132°27'E, sandstone boulders in monsoon forest, 200 m, 21.iii.1986, leg. G.Rambold 5105 (M), 5116 (M, NT); -- Victoria River, 1 km W of Victoria River Inn, 15°37'S, 131°09'E, E facing scree slope below sheer cliffs of mountain, on sandstone boulders, c. 80 m, 26.iii.1986, leg. G.Rambold 5198, 5204 (M); -- Pinkerton Range, Bullo River Road, 16 km NW of West Baines River Crossing on the Victoria Hwy, 15°49'S, 129°40'E, 200 m, 9.v.1988, leg. J.A.Elix 22080 (ANUC).

Tephromela armeniaca (DC.) Hertel & Rambold

HERTEL & RAMBOLD, Bot. Jahrb. Syst. **107**: 494 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 148 (1986); EGAN, Bryologist **90** (2): 156 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 17, 182 (1988).

≡ *Rhizocarpon armeniacum* DC. in Lam. & DC., Fl. Franc., ed. 3, 2: 366 - 367 (1805).

≡ *Lecidea armeniaca* (DC.) Fr., Syst. Orb. Veget. 1: 286 (1825); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 516 - 517 no. 6294 (1925); 8: 331 (1932); ANDERSON, The Genus *Lecidea* Rocky Mtn Nat. Park: 74 - 76 (1964); WEBER & WETMORE, Beih. Nova Hedwigia **41**: 51 (1972); HERTEL, Khumbu Himal **6** (3): 293 - 294 (1977); FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); SANTESSON, Lich. Sweden Norway: 159 (1984); CLAUZADE & ROUX, Bull. Soc. Bot. Centre-Ouest, N.S. **18**: 198 (1987).

≡ *Psora armeniaca* (DC.) Massal., Ricerche Lich.: 92 (1852).

≡ *Lecidella armeniaca* (DC.) Kremp., Lich. Fl. Bayerns: 192 (1861).

Typus: FRANCE: "Pyrenées", [no date], leg. L.F.E.Ramond de Car-bonnière (G-DC!), holotype - [not analyzed chemically].

DESCRIPTION:

Thallus: areolate to bullate-areolate, up to several cm diam., 0.4 - 2 mm thick.

AREOLES: irregularly shaped, orange-brown to pale brownish, irregularly convex, with smooth surface, c. 0.9 - 1.3 mm, max. 1.2 - 2 mm diam. Cortex 40 - 60 μ m thick; upper cell layer greyish due to lichen substances, not pigmented; hyphae c. 4 μ m diam.; epinecral layer 15 - 40 μ m thick. Algal layer c. 80 - 120 μ m thick; algal cells c. 8 - 10 μ m, max. 12 - 13 μ m diam. Medulla I -; hyphae c. 4 μ m thick.

HYPOTHALLUS: black, well developed between the areoles.

Apothecia: not developed in Australian material. Morphology and anatomy of the apothecia from Northern Hemisphere specimens have been described in detail by ANDERSON (l.c.) and HERTEL (l.c.).

Pycnidia: immersed, 140 x 200 μ m. Conidia 6.5 - 10 x 1.5 - 1.8 μ m. [see also HERTEL & RAMBOLD 1985: 489, fig. 7f].



Map 24. Distribution of *Tephromela armeniaca* in continental Australia

CHEMISTRY:

Cortex K+ red, C-, P+ yellow; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing alectorialic acid, protocetraric acid, roccellic acid (4 specimens examined).

DISTRIBUTION:

Bipolar. This species is widely distributed in the Northern Hemisphere, occurring in alpine habitats of the holarctic region (HERTEL 1977: 294). From the Southern Hemisphere, it is only known from continental Australia (WEBER & WETMORE l.c.), where it was found only in the Mt Kosciusko area, growing on exposed siliceous rock (map 24).

NOTES:

T. armeniaca is characterized by a bullate-areolate, nitid thallus with a mostly well developed hypothallus and by the content of alectorialic acid, which is not known from any other lecideoid lichen species. It is closely related to *T. testaceoatra* (Vain.) Hertel & Rambold, which, however, contains psoromic acid and occurs only in the Northern Hemisphere. Within the Australian material, fertile specimens have yet to be found. *T. armeniaca* is a facultative juvenile parasite on *Sporastatia testudinea* (Ach.) Massal.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, N exposed vertical and overhanging rock wall beside track, 2000 m, 17.i.1986, leg. G.Rambold 3601 (M), 3605 (M, NSW); -- Kosciusko National Park, Mt Kosciusko, on trail to Northcote Pass, [36°26'S, 148°16'E], 7000 ft, 10.xi.1967, leg. W.A.Weber & D.McVean (COLO L-47190); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31685 (M).

Tephromela atra (Huds.) Hafellner in Kalb

KALB, Lich. Neotrop., fasc. VII: 15, no. 297 (1983); HAFELLNER, Beih. Nova Hedwigia 79: 344 (1984); HERTEL & RAMBOLD, Bot. Jahrb. Syst. 107: 492 - 494 (1985); NIMIS & POELT, Studia Geobot. 7, suppl. 1: 228 - 229 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 17, 182 (1988).

≡ *Lichen ater* Huds., Flora Anglica 1: 445 (1762) [n.v.].

≡ *Lecanora atra* (Huds.) Ach., Lichenogr. Univ.: 344 (1810); ZAHLBRUCKNER, Catal. Lich. Univ. 5: 378 - 383 no. 10173 (1928); HERTEL, Willdenowia 6: 234 (1971); POELT & VEZDA, Biblioth. Lich. 16: 172 (1981); SANTESSON, Lich. Sweden Norway: 141 (1984).

Type: ENGLAND: [n.v.] - "Habitat in arboribus et muris frequens" (vide protologue) [type probably burnt 1783 (see HERTEL (1971: 234) and LAUNDON (1979: 11))].

= *Lecanora atra* var. *serialis* Müll.Arg.

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 3: 632 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 5: 387 (1928); WEBER & WETMORE, Beih. Nova Hedwigia 41: 47 (1972); ROGERS, Muelleria 5 (1): 31 - 32 (1982), FILSON, Checklist Austr. Lich. 1. ed.: 41 (1983); Checklist Austr. Lich. 2. ed.: 52 (1986); Austr. Fl. Fauna Ser. 4: 102 (1986); Checklist Austr. Lich. 3. ed.: 97 (1988).

Type: AUSTRALIA: Queensland: Thursday Island, 1887, leg. Ch. Knight 268 (G!, holotype) - [according to ROGERS (1982a) containing atranorin, alectoronic acid, α -collatolic acid, phenolics].

? = *Lecanora atra* var. *australica* Räs.,

RÄSÄNEN, Ann. Soc. Zool. Bot. Fenn. Vanamo 3: 179 (1949); LAMB, Index Nom. Lich.: 294 (1963); WEBER & WETMORE, Beih. Nova Hedwigia 41: 46 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 41 (1983); Checklist Austr. Lich. 2. ed.: 52 (1986); Austr. Fl. Fauna Ser. 4: 102 (1986); Checklist Austr. Lich. 3. ed.: 16, 97 (1988).

Type: AUSTRALIA: Queensland: Korunda Cavins [= Kuranda, c. 20 km NW of Cairns - vide FILSON 1986b: 102], 1893, leg. F.R. M. Wilson (H, holotype) - [n.v.].

= *Lecidea korundensis* Räs. **syn. nov.**

RÄSÄNEN, Ann. Soc. Zool. Bot. Fenn. Vanamo 3: 183 (1949); LAMB, Index Nom. Lich.: 361 (1963); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 121 (1986); Checklist Austr. Lich. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: Queensland: Korunda, Cavins [= Kuranda, c. 20 km NW of Cairns - vide FILSON 1986b: 121], viii.1893, leg. F.R.M. Wilson (H!, holotype) - [containing atranorin].

= *Lecidea promontorii* Zahlbr. **syn. nov.**

ZAHLBRUCKNER, Ann. Crypt. Exot. 5: 232 (1932); SCHNEIDER, Bibl. Lichenol. 13: 245, 261, 262 (1980).

Type: REP. SOUTH AFRICA: Cape Prov.: Abhang des Tafelberg gegen Campsbay, c. 20 - 30 m, 12.x.1909, leg. J. Brunthaler (W!, holotype).

= *Heppsora indica* Awasthi & K. Singh **syn. nov.**

AWASTHI & SINGH, Bryologist 80: 537-538 (1977); SCHNEIDER, Bibl. Lichenol. 13: 182 (1980); HAFELLNER, Beih. Nova Hedwigia 79: 292 (1984).

Type: INDIA: Near the village, Booparai area, Palni Hills, Tamil Nadu, on moist vertical rocks (water dripping down the surface) by the roadside, 1800 m, 18.xii.1970, leg. K.P. Singh 70.1136 (LWU, holotype; UPS, US, M isotypes) - [containing atranorin, alectoronic acid, α -collatolic acid, according to the original description].

DESCRIPTION:

Thallus: areolate to rimose-areolate, up to several cm diam., 0.3 - 0.5 mm thick.

AREOLES: angular to irregularly shaped, white, rarely pale grey, plane to subconvex, with smooth surface, c. 0.5 - 0.8 mm, max. 1.2 - 1.5 mm diam. Cortex 15 - 30 μ m thick; upper cell layer not pigmented; hyphae c. 3 - 4 μ m diam.; epinecral layer 5 - 10 μ m thick. Algal layer c. 50 - 100 μ m thick; algal cells c. 8 - 12 μ m, max. 10 - 16 μ m diam. Medulla I -; hyphae 3 - 5 μ m thick.

HYPOTHALLUS: mostly well developed, obvious between the areoles and at the thallus margin.

Apothecia: roundish, dispersed to crowded, 10 - 20/cm², sessile, constricted at the base or not, c. 0.8 - 1 mm, max. 1.2 - 2 mm diam. Disc plane to convex, black, nitid, epruinose. Margin thalline, white, matt, well developed and mostly persistent or thalline margin not developed (then apothecia as in *T. armeniaca* or *T. aglaea*).

EXCIPULUM: max. 200 μ m, lateral of hymenium up to 200 μ m thick. Ectal zone colourless; hyphae 4 μ m diam., with lumina of c. 2 μ m. Inner zone colourless; hyphae c. 4 - 5 μ m diam., with lumina of 2 μ m. Medullary zone well developed.

HYPOTHECIUM: brown to yellow-brown, 100 - 150 μ m tall; hyphae 4 - 5 μ m diam.; subhymenial layer pale violet, 200 - 300 μ m tall.

HYMENIUM: 50 - 60 μ m tall, violet to violet-brown, I+ blue, I_{conc.}+ blue. Epihymenium dark violet-brown, 15 - 20 μ m tall. Paraphyses branched and anastomosing, 4 - 5 μ m, apical 4 - 5 μ m thick. Asci c. 50 x 10 - 12 μ m; tholus max. 12 - 15 μ m, min. 10 - 13 μ m thick; outer amyloid wall layer 1 μ m thick, I+ brown, I_{conc.}+ brown; non-amyloid wall layer 0.5 μ m thick; masse axiale c. 2 μ m broad; amyloid zone above masse axiale c. 3 - 5 μ m tall. Spores ellipsoid, 9 - 11 x 5.5 - 7 μ m.

Pycnidia: immersed. Conidia cylindrical, 9 - 12.5 x 1 - 1.5 μ m [see also AWASTHI & SINGH 1977: 538 and HERTEL & RAMBOLD 1985: 489, fig. 7d].

CHEMISTRY:

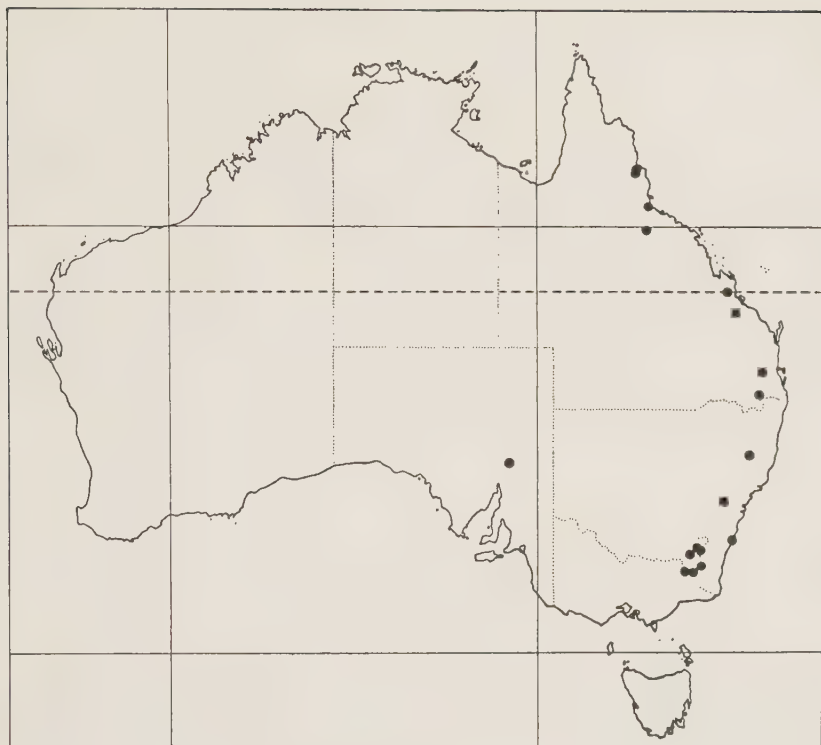
Cortex K+ yellow, P+ yellow, C-; medulla: K-, P-, C-; excipulum: K-, P-, C-.

Four chemotypes observed:

- a) containing atranorin, alectoronic acid, α -collatolic acid (13 specimens examined);
- b) containing additional bourgeanic acid (2 specimens examined);
- c) containing atranorin, α -collatolic acid (4 specimens examined);
- d) containing atranorin only (1 specimen examined).

DISTRIBUTION:

Cosmopolitan (?). *T. atra* is widely distributed in the Northern and Southern Hemisphere. It occurs from sea level to the alpine zone,



Map 25. Distribution of *Tephromela atra* in continental Australia

growing on exposed siliceous and calcareous rocks and on bark. Within continental Australia, saxicolous specimens of this species have been collected in S.A., Qld, N.S.W., A.C.T., and Vic. (map. 25), growing on siliceous rock. Corticolous material is not considered in this study.

NOTES:

T. atra is characterized by the presence of atranorin, α -collatolic acid, alectoronic acid and bourgeanic acid in various concentrations and combinations and by a violet hymenial pigmentation. This polymorphic species varies in the margination, adnation of the apothecia and development of the thallus (crustose to $\pm$ psoroid). It typically has sessile apothecia with a well developed thalline margin. Specimens with a reduced margin habitually resemble the lecideoid species *Tephromela aglaea* (Sommerf.) Hertel & Rambold. *Lecidea korundensis* from Queensland, *Heppsonia indica* described from India, and *Lecidea pro-*

montorii Zahlbr. from South Africa represent such modified growth types. Two species, which are rather closely related to *T. atra*, are *T. eatoni* from Kerguelen Islands, and *T. arafurensis* from the northern parts of Western Australia and the Northern Territory. The latter species is lecanoroid, has a colourless to reddish hymenium and contains perlatic acid, glomelliferic acid and anziaic acid (in traces) along with atranorin, while *T. eatoni* is lecideoid, has a reddish hymenium and contains an unknown substance, according to HERTEL & RAMBOLD (1985). The type specimen of *Lecanora atra* var. *australica* Räs., being collected at the same locality as *L. korundensis* [= *T. atra*], was not examined, but according to the original description ("...Hymenium ... violascens..."), this taxon seems to be synonymous with *T. atra*. *Heppsoara indica* and *Lecidea promontorii* show the same combination of anatomical and chemical characters as *Tephromela atra*: asci of "Bacidia -type", paraphyses thick-walled, hymenium (and hypothecium) violet, thallus containing atranorin, aleatoric acid and α -collatolic acid. Therefore, these taxa are regarded as synonymous to *T. atra*. The creamy colour of the thallus in *L. promontorii* is not relevant, as it is due to incrustated cortical lichen substances (atranorin) and not to a pigment.

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 219 ("*Tephromela atra* ") (M)

SPECIMENS EXAMINED:

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G.Rambold 5495, 5498, 5518, 5526, 5529, 5531, 5534, 5536, 5545 (M), 5549 (Hertel, Lecideac. Exs. no. 219); -- 8 mi E of Springton (?), 1100 ft, 15.x.1974, leg. J.A.Elix 465 (ANUC).

Queensland: Thursday Island, [10°35'S, 142°13'E], 1887, leg. Ch.Knight "268" (type of *Lecanora atra* var. *serialis* Müll. Arg., G) [locality probably not correct, see p. 319]; -- Korunda, "Cavins" (=Cairns?), [16°49'S, 145°38'E], viii.1893, leg. F.R.M.Wilson (type of *Lecidea korundensis* Räs., H); -- Korunda, "Cavins" (=Cairns?), [16°49'S, 145°38'E], 1893, leg. F.R.M.Wilson (type of *Lecanora atra* var. *australica* Räs., H); -- Bartle Frere, Tinaroo Falls, [17°10'S, 145°35'E], 15.viii.1987, leg. H.T.Lumbsch 5414 c (hb. Lumbsch); -- Crystal Creek National Park, Little Crystal Creek, 19°01'S, 146°16'E, rocky outcrops and boulders beside falls, c. 365 m, 25.ii.1986, leg. G.Rambold 4809 (M); -- 12 km W of Charters Towers, beside Flinders Highway, 20°07'S, 146°10'E, SE exposed rocky outcrops on slope, 340 m, 23.ii.1986, leg. G.Rambold 4708 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, vertical and overhanging surface of E exposed rocky outcrops, 480 m, 13.ii.1986, leg. G.Rambold 4451 (M); -- Krombit Tops National Park, 2 km S of Forestry Barracks, 24°22'S, 151°00'E, 900 m, [no date], leg. R.W.Rogers 7890 (BRIU); -- Brisbane area, Esk shire, 5 km S of Toogoolawah, [27°07'S, 152°23'E], 22.ix.1987, leg. H.T.Lumbsch 5668 g (hb. Lumbsch); -- Brisbane area, Mistake Mtns, near Doggs Fall, 28°20'S, 152°20'E, 29.ix.1987, leg. H.T.Lumbsch 5699 j (hb. Lumbsch).

New South Wales: Du Fours Lookout, 1.5 km W of Mount Wilson, 33°30'S, 150°22'E, westerly exposed sandstone outcrops, 960 m, 2.ii.1986, leg. G.Rambold 4171 (M); -- 3 mi N of Kiandra, [35°50'S, 148°30'E], 13.v.1968, leg. R.Filson 10900 (MEL); -- Cooma, 1 km NNW of town, 36°13'S, 149°08'E, low outcrops on slope, in open low *Eucalyptus* woodland beside road to Rosedale, 850 m, 19.i.1986, leg. G. Rambold 3675 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, N exposed vertical and over-

hanging rock wall beside track, 2000 m, 17.i.1986, leg. G.Rambold 3595 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3488 (M); -- Jindabyne, 36°26'S, 148°37'E, granitic boulders near camping ground, 930 m, 13.i.1986, leg. G.Rambold 3402 (M); -- Newport, [no date], leg. F.R.M. Wilson (NSW 155819); -- Lilli Pilli Beach, 2 m, 5.ix.1975, leg. J.A.Elix 1196 (ANUC).

A.C.T.: Jervis Bay Territory, Stony Creek near Cape St George, 35°10'S, 150°46'E, rocks and boulders beside creek, 10 m, 23.i.1986, leg. G.Rambold 3873 (M); -- Trail to Booroomba Rocks, 11 km SW of Tharwa, 1340 m, 22.ii.1984, leg. J.A.Elix 11812 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m, 27.i.1986, leg. J.A.Elix 19828 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4031 (M); -- Gudgenby River Gorge, 4.5 km S of Tharwa, [35°33'S, 149°04'E], 680 m, 26.vi.1979, leg. J.A.Elix 6085 (ANUC); -- 1 km downstream from Casuarina Sands, 530 m, 13.vi.1975, leg. J.A.Elix 919, 922, 923 (ANUC).

Victoria: Bogong Highplains, Mt Jim, 27.i.1967, leg. R.Filson 9636 (MEL).

Tylothallia P.James & Kilius in Kilius

KILIUS, Herzogia 5: 409 (1981); HAFELLNER, Beih. Nova Hedwigia 79: 268 (1984); HERTEL, Beih. Nova Hedwigia 79: 459 (1984).

Typus generis: *Tylothallia biformigera* (Leight.) P.James & Kilius - (holotype).

Tylothallia includes two species, both saxicolous. One occurs in the Northern Hemisphere (*T. biformigera* (Leight.) P. James & Kilius), the other (*T. pahiensis*), is only known from the Southern Hemisphere. The main characters of this genus are asci of the *Bacidia*-type with an amyloid zone above the masse axiale, simple to 1-septate spores, and small, ovoid-oblong conidia.

Tylothallia pahiensis (Zahlbr.) Hertel & Kilius in Hertel

HERTEL, Mitt. Bot. Staatssamml. München 19: 446 (1983); Beih. Nova Hedwigia 79: 459 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 152 (1986); HERTEL, Mitt. Bot. Staatssamml. München 23: 337 - 338 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 186 (1988).

= *Lecidea pahiensis* Zahlbr., Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 104: 303 (1941) [reprints p. 55].

= "*Catillaria pahiensis* (Zahlbr.)" comb. prov. in HERTEL, Herzogia 2: 38 - 39 (1970).

Type: NEW ZEALAND: South Island: Southland, Foveaux Strait, Pahia Point (W of Riverton), granitic coastal rocks, viii.1935, leg. J.S.Thomson (W, holotype, BM!, isotype) - [containing atranorin, gangaleoidin].

DESCRIPTION:

Thallus: rimose-areolate up to 60 mm diam., 0.5 - 1.8 mm thick.

AREOLES: irregularly shaped, white to weakly tinged yellow, irregularly convex, with smooth or wrinkled surface, c. 0.6 - 0.9 mm, max. 1.2 - 3.0 mm diam. Cortex 15 - 20 μ m thick; upper cell layer colourless to grey pigmented; hyphae c. 3.5 - 5 μ m diam.; epinecral layer not obvious. Algal layer c. 60 - 250 μ m thick; algal cells c. 8 - 9 μ m, max. 11 - 15 μ m diam. Medulla I -; hyphae 3 - 5 μ m thick.

HYPOTHALLUS: black to grey, obvious between the areoles or not developed.

Apothecia: irregularly roundish, mostly dispersed, 5 - 50/cm², constricted at the base, c. 0.5 - 1.0 mm, max. 0.9 - 1.6 mm diam. Disc mostly plane, black, matt, epruinose. Margin distinct and more or less persistent, black, subnitid.

EXCIPULUM: max. 120 - 200 μ m, lateral of hymenium 70 - 100 μ m thick. Ectal zone dark green to black; pigmented zone 10 - 15 μ m thick; hyphae 5 - 7 μ m diam., with lumina of c. 2 μ m. Inner zone colourless to grey due to incrustated lichen substances; hyphae 4 - 6 μ m diam., with lumina of 1 - 2 μ m. Medullary zone not obvious.

HYPOTHECIUM: colourless to faint brown; hyphae 3 - 4 μ m diam.; subhymenial layer pale brown to colourless.

HYMENIUM: 30 - 45 μ m tall, colourless to weakly tinged brown, I $\pm$ blue, Iconc.+ blue or -. Epihymenium black, 8 - 15 μ m tall. Paraphyses occasionally branched and anastomosing, 1.6 - 2 μ m, apices 3.5 - 4 μ m thick. Asci c. 28 - 35 x 9 - 12 μ m; tholus max. 6 - 8 μ m, min. 2 - 5 μ m thick; masse axiale obvious; amyloid zone above masse axiale c. 1.5 μ m thick; outer amyloid wall layer c. 1 - 2 μ m thick, I $\pm$ brown, Iconc.+ brown; non-amyloid wall layer c. 0.3 μ m thick. Spores ellipsoid, non- to 1-septate, 8 - 14 x 4 - 5 μ m.

Pycnidia: immersed. Conidia ovoid-oblong, c. 3 - 4 x 2 μ m.

CHEMISTRY:

Thallus: Cortex K+ yellowish, P $\pm$ yellow, C-; medulla: K-, P-, C-; excipulum: K-, P-, C-.

Two chemotypes observed:

- a) containing atranorin, lecideoidin (6 specimens examined);
- b) containing atranorin, gangaleoidin (6 specimens examined).

DISTRIBUTION:

Australasian. *T. pahiensis* is known from New Zealand (HERTEL 1983, 1984), from Tasmania (HERTEL 1987b) and occurs within continental Australia in S.A., N.S.W., and Vic. (map 26), growing on coastal rocks.

NOTES:

This species is well characterized by a colourless to pale brownish hypothecium, non- to 1-septate spores and the production of either gangaleoidin or lecideoidin along with atranorin. Both chemotypes are anatomically, morphologically and ecologically identical. *T. biformigera* from the Northern Hemisphere contains atranorin, 2'-O-methylperlatolic acid, norstictic acid and fumarprotocetraric acid in varying combinations and concentrations, according to KILLIAS (1981: 393).



Map 26. Distribution of *Tylothallia pahiensis* in continental Australia

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 140: ("*Tylothallia pahiensis* ") (M)

SPECIMENS EXAMINED:

South Australia: Southern Lofty, Encounter Bay, [35°35'S, 138°36'E], v.1929, [atr., gangal.], leg. J.B.Cleland 5461 (AD); -- Kangaroo Island, King George Beach, 35°40'S, 137°04'E, 2 m, 30.x.1985, [atr., lecid.], leg. J.A.Elix 19754 (ANUC); -- Kangaroo Island, Dudley Peninsula, Hog Bay, Penneshaw, 35°43'S, 137°57'E, 2 m, 28.x.1985, [atr., gangal.], leg. J.A.Elix 19680 (ANUC); -- Kangaroo Island, Point Ellen, 2 km S of Vivonne Bay, 36°00'S, 137°11'E, 4 m, 25.x.1985, [atr., gangal.], leg. J.A.Elix 19594 (ANUC).

New South Wales: South Coast, Moruya Heads, 6 km from Moruya, 35°55'S, 150°08'E, 3 m, 12.iv.1975, [atr., gangal.], leg. D.Verdon 1107C (CBG); -- Baragoot Point, 3.5 km S of Bermagui, [36°25'S, 150°04'E], 6 m, 4.iii.1978, [atr., lecid.], leg. J.A.Elix 4583 (HERTEL, Lecideac. Exs. no. 140, M); -- Baragoot Point, 3.5 km S of Bermagui, [36°25'S, 150°04'E], on rocks in heathland, 6 m, 4.iii.1978, [atr., lecid.], leg. J.A.Elix 4587 (ANUC, MEL).

A.C.T.: Jervis Bay Territory, Moes Rock near Cape St George, 35°09'S, 150°46'E, coastal rocks, 0 m, 23.i.1986, [atr., lecid.], leg. G.Rambold 3843, 3857 (M); -- [atr., gangal.], 3853 (M, CBG).
Victoria: Cape Liptrap, [38°54'S, 145°55'E], 5.iv.1967, [atr., lecid.], leg. H.A.Morrison (MEL 1018556).

Lecideaceae Chevalier

CHEVALIER, Flore Environs Paris: 549 (1826) p.p. [n.v.]; Hafellner, Beih. Nova Hedwigia 79: 298 (1984).

Type: *Lecidea* Ach.

Within the Lecideaceae, three genera are distinguished: *Lecidea* Ach., *Melanolecia* Hertel and the lichenicolous genus *Cecidonia* Triebel & Rambold. The latter two are preliminarily included into the Lecideaceae for want of a better solution and do not occur in Australia. The main differences between these genera are discussed in TRIEBEL & RAMBOLD (1988: 282 - 283). The genus *Rhizolecia* Hertel from New Zealand, which has also been attached to this family, has not been examined by the author, but is - according to the original description - probably closely related to *Lecidea* subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann. The members of these genera are characterized by an amyloid cap in the tholus with more or less distinct tube-like processes towards the base (fig. 2f). The processes can be observed especially in species with relatively big asci (e.g. in *Lecidea lygoma* and *Cecidonia umbonella*), but are not always developed.

In continental Australia, the species of *Lecidea* subg. *Lecidea* are widely distributed, occurring in the semi-arid regions of the southern and central parts (map 27). With *L. sarcogynoides* this subgenus reaches c. 1650 m altitude in the Mt Kosciusko area and on the other hand with *L. terrena* it extends to (sub-)tropical latitudes (17 °S) at relatively low altitudes.

Lecidea Ach.

ACHARIUS Method. Lich.: 32 - 86 (1803) p.p.; HERTEL, Khumbu Himal 6 (3): 226 (1977) p.p.; Beih. Nova Hedwigia 79: 416 (1984).

Typus generis: *L. fuscoatra* (L.) Ach. - (lectotype, designated in SANTESSON 1952: 425).

Lecidea Ach. in the delimitation of HERTEL (1977 p.p., 1984) has to be divided into three subgeneric units:

1. *Lecidea* subg. *Lecidea*

This subgenus comprises non-alpine, mostly thermophilous species with relatively short conidia and a I+ red to brown hymenium (fig. 14, p. 160; fig. 15, p. 161; map 27, p. 162; tab. 9, p. 163).

2. *Lecidea* subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann
comb. nov.

≡ *Patellaria* sect. *Rehmiopsis* Müll.Arg., Flora 55: 537 (1872); LAMB, Lichenologist 4: 73 - 74 (1968).

Type: *Patellaria heterodoxa* Müll.Arg. [= *Lecidea lapicida* (Ach.) Ach. - fide HERTEL (1977: 226)].

This subgenus comprises more or less alpine species with relatively long conidia and a I + blue to blue-brown hymenium.

3. *Lecidea* subg. *Cladopycnidium* (H.Magn.) Hertel, Rambold &
Pietschmann comb. nov.

≡ *Cladopycnidium* H.Magn., Lich. Central Asia 1: 61 (1940).

Type: *Cladopycnidium sinense* H.Magn. [= *Lecidea tessellata* Flk. - fide HERTEL (1977: 226)].

This subgenus is defined by a I+ bluish hymenium, cylindrical conidia, and thick spore walls (up to c. 1.5 µm). It comprises the Northern Hemisphere species *L. tessellata* Flk. (incl. *L. verruca* Poelt), which usually occur in alpine habitats.

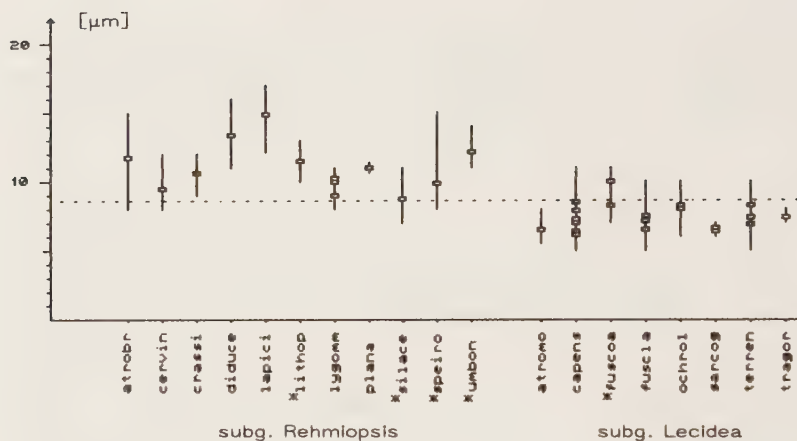


Fig. 14. Length of conidiospores in species of *Lecidea* subg. *Lecidea* (*L. atromorio*, *L. capensis*, *L. fuscoatra*, *L. fuscoatrula*, *L. ochroleuca*, *L. sarcogynoides*, *L. terrena*, *L. tragorum*) and of *Lecidea* subg. *Rehmiopsis* (*L. atrobrunnea*, *L. cerviniicola*, *L. crassilabra*, *L. diducens*, *L. lapicida*, *L. lithophila*, *L. lygomma*, *L. plana*, *L. silacea*, *L. speirodes*, *L. umbonata*) [* = not occurring in Australia]

Lecidea subg. *Lecidea*

HERTEL, Beih. Nova Hedwigia **24**: 35 - 63 (1967).

Type: *Lecidea fuscoatra* (L.) Ach.

The separation of subg. *Lecidea* and subg. *Rehmiopsis* is problematical since *L. fuscoatra*, the type species of *Lecidea* (and of subg. *Lecidea*), shows intermediate features of both subgenera. In European material of this species, conidia of less than 8.5 μm average length as well as longer ones were observed. However, the hymenium reaction in iodine is more red-brown than bluish and the ecology of *L. fuscoatra* closely resembles that of the other species included in subg. *Lecidea*.

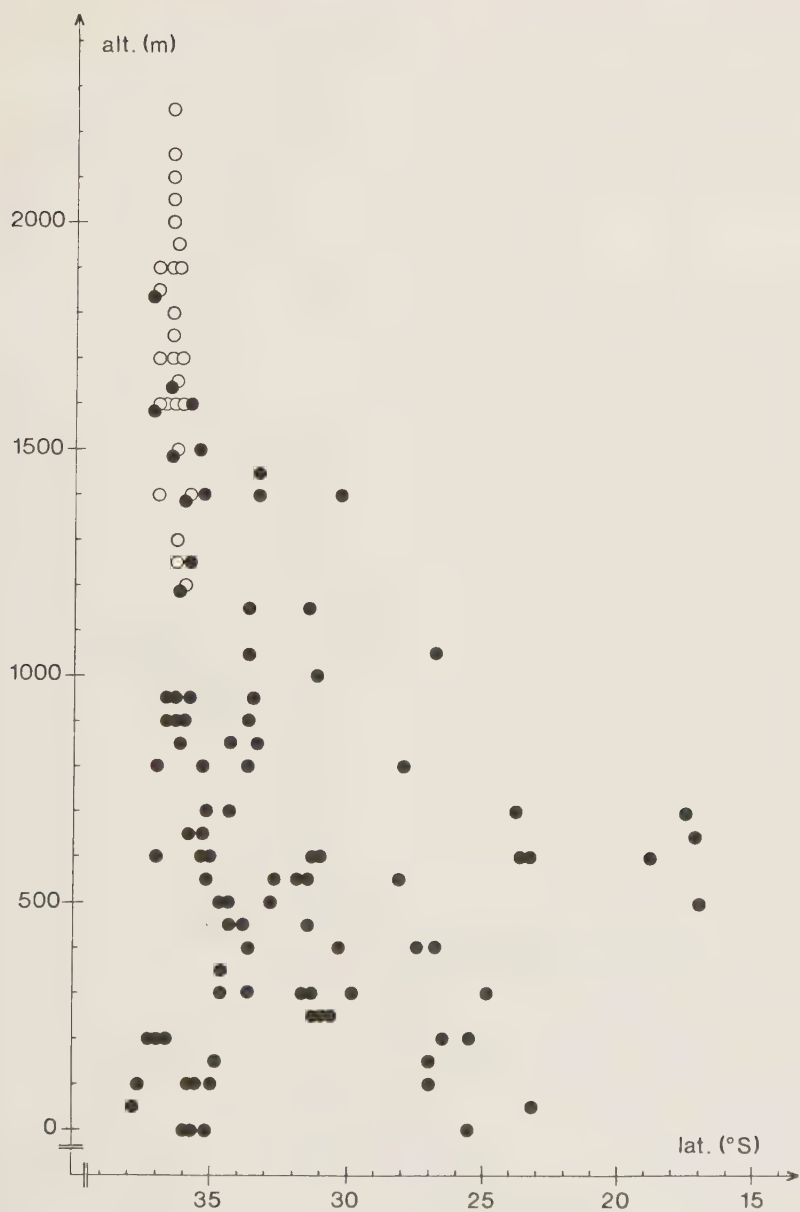
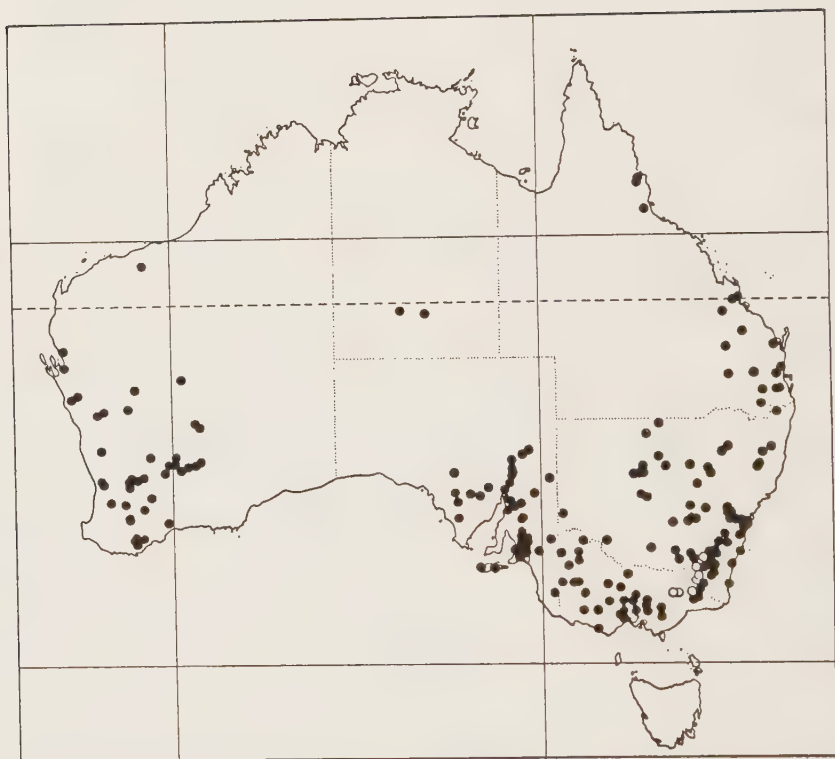


Fig. 15. Altitude-latitude diagram of *Lecidea* subg. *Lecidea* [●] and *Lecidea* subg. *Rehmiopsis* [○] in continental Australia



Map 27. Distribution of *Lecidea* subg. *Lecidea* [●] and *Lecidea* subg. *Rehmiopsis* [○] in continental Australia

Table 9. Some diagnostically important characters of the species of *Lecidea* occurring in Australia:

1.) Adnation of apothecia; 2.) colour of hymenium; 3.) colour reaction of the hymenium in Lugol's solution; 4.) average breadth of spores [μm]; 5.) maximal thickness of the apices of the paraphyses; 6.) colour of the hypothecium; 7.) colour of the thallus; 8.) development of an epinecral layer; 9.) amyloid reaction of the medulla in Lugol's solution; 10.) development of a hypothallus; [for conidia length refer to fig. 14].

[bl = blue; br = brown; cl = colourless; dbr = dark brown; gr = green; gre = grey; i = immersed; oc = ochraceous; orr = orange-red; pbr = pale brown; r = red; se = sessile; si = subimmersed; up = unpigmented; w = white; * = extra - Australian].

	Apoth. adn.	Hym. colour	Hym. l+	Spores av. br	Par. ap. Q max	Hypoth. colour	Thallus colour	Epinecral layer	Med. l+	Hyp. th.
sg. <i>Lecidea</i>										
<i>atromorio</i>	si/i	r/up	orr	c. 4	3-4	dbr	br	+	-	+
<i>fuscoatra</i> *	se/si	up	orr/br	4-6	3-4	dbr	w/br	+	-	+
<i>fuscoatrula</i>	si/i	r/up	orr	4-5	-4	dbr	oc/br	+	+	+
<i>tragorum</i>	se	up(r)	orr	4-5	-4	dbr	oc/br	+	-	-
<i>capensis</i>	se	up	orr	c. 4	3-4	dbr	oc/br	+	-	+
<i>sarcogynoides</i>	se	r/up	br	3-4	3-4	dbr	w	-	-	-
<i>ochroleuca</i>	se	up/gr	orr	5-7	3	dbr	w/gre	-	-	-
<i>terrena</i>	se	up/gr	orr	4-7	3	dbr	w/gre	-	-	+-
sg. <i>Rehmiopsis</i>										
<i>atrobrunnea</i>	se	up/gr	+-bl	4-5	3-4	pbr	br	+	+	+
<i>lapidica</i> agg.	se/si	up	+-bl	5-7	3-4	cl-dbr	w-gre	-	+	+
<i>lygoma</i> agg.	se/i	up	+-bl	5-7	3-4	dbr	w-gre	-	-	+-
<i>plana</i>	se	up	+-bl	3-4	3-4	cl	w-gre	-	-	+-
<i>promisc.</i> agg.	se	up	+-bl	c. 3.5	4-5	dbr	w-gre	-	+	-
<i>diducens</i>	se	up/gr	+-bl	2.5-3	3-4	br	w-gre	-	+	+

Table 10. The distribution of lichen substances within the species of *Lecidea* occurring in Australia

[anz = anziaic acid (+ perlatolic acid); 2'-O-methylanziaic acid; confl = confluentic acid; gyr = gyrophoric acid (+ lecanoric acid); 2'-O-mp = 2'-O-methylperlatolic acid; 2'-O-mmp = 2'-O-methylmicrophyllinic acid; plan = planaic acid (+ 4-O-demethylplanaic acid); porph = porphyritic acid; stic/nst = stictic acid, norstictic acid; * = extra - Australian].

	gyr	confl	2'-O-mp	2'-O-mmp	anz	plan	stic/nst	porph
sg. <i>Lecidea</i>								
<i>atromorio</i>	+						+	
<i>capensis</i>		±	+					
<i>fuscoatra</i> *	+							
<i>fuscoatrula</i>				+			+	
<i>tragorum</i>		+						
<i>sarcogynoides</i>								
<i>ochroleuca</i>	+							
<i>terrena</i>		+						
sg. <i>Rehmiopsis</i>								
<i>atrobrunnea</i>			+					
<i>diducens</i>					+			
<i>lapidica</i> agg.							+	
<i>lygomma</i> agg.							+	+
<i>plana</i>						+		
<i>promisc.</i> agg.		+			+			

***Lecidea atromorio* Knight**

["*Lecidea atro-morio*"], KNIGHT, Trans. & Proc. New Zealand Inst. 8: 315 - 316 (1876); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 525 no. 6309 (1925); HERTEL, Beih. Nova Hedwigia 79: 417, 485, 489 (1984); HERTEL, Mitt. Bot. Staatssamml. München 21: 321 - 322 (1985).

Type: NEW ZEALAND: "on rocks", [no locality, no date], leg. Ch. Knight (M!, lectotype - designated in HERTEL 1984) - [containing gyrophoric acid].

= *Lecidea fumosella* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 1: 47 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 578 no. 6437 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 47 (1983); FILSON, Checklist Austr. Lich. 2. ed.: 59 (1986); FILSON, Austr. Fl. Fauna Ser. 4: 118 (1986); Checklist Austr. Lich. 3. ed.: 19, 103 (1988).

Type: AUSTRALIA: Victoria: Little River, [comm.] 1891, leg. F.R.M. Wilson 1436 (G!, holotype; MEL 6948!, NSW 180243!, isotypes - [coll. 1887]) - [containing gyrophoric acid].

DESCRIPTION:

Thallus: areolate, up to 75 mm diam., 0.1 - 0.3 (- 0.5) mm thick.

AREOLES: angular, pale brown to brown, plane to subconvex, with smooth to nitid surface, c. 0.3 - 0.6 mm, max. 0.7 - 1.2 mm diam. Cortex c. 30 µm thick; upper cell layer pale brown to brown; hyphae c. 4 - 5 µm diam.; epinecral layer 12 - 40 µm thick. Algal layer c. 80 - 150 µm thick; algal cells c. 9 - 10 µm, max. 9 - 15 µm diam. Medulla I -, hyphae 3 - 4 µm thick.

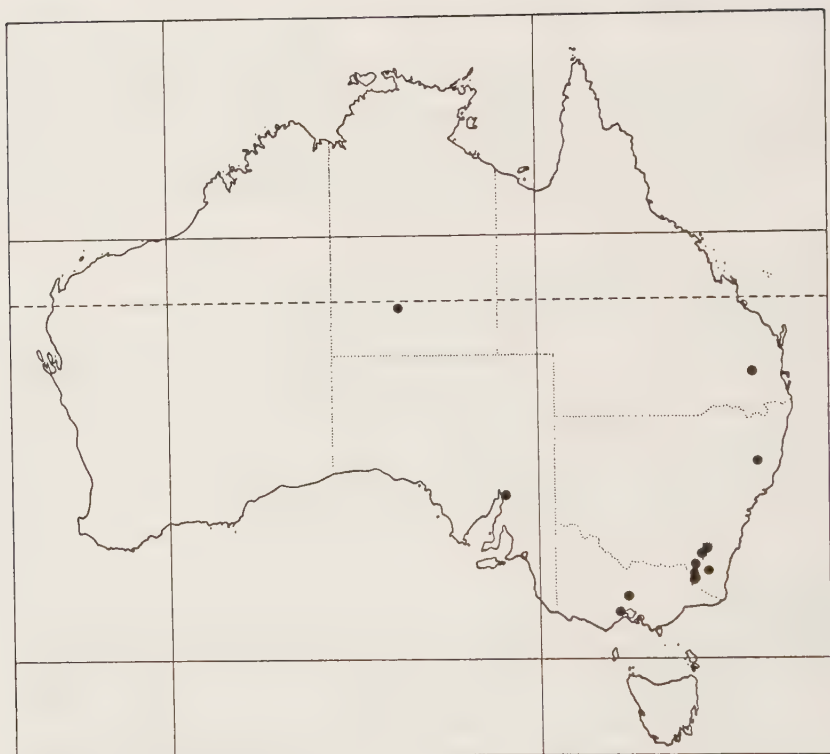
HYPOTHALLUS: black, obvious between the areoles and at the thallus margin.

Apothecia: roundish to angular, dispersed to crowded, 50 - 200/cm², immersed to subimmersed, c. 0.3 - 0.5 mm, max. 0.7 mm diam. Disc plane to subplane, black, matt, epruinose. Margin indistinct, grey, matt.

EXCIPULUM: more or less reduced, lateral of hymenium 30 - 40 µm thick. Ectal zone brownish, green to grey-black; pigmented zone c. 10 - 20 µm thick; hyphae 3.5 - 5 µm diam., with lumina of 1 - 3 µm. Inner zone dark grey to brown; hyphae c. 3 µm diam., with lumina of 1.5 - 2 µm. Medullary zone mostly developed.

HYPOTHECIUM: brown to dark brown, 55 - 120 µm thick; hyphae 3 - 3.5 µm diam.; subhymenial layer colourless to pale brown, 10 - 30 µm thick.

HYMENIUM: 35 - 60 µm tall, colourless to weakly tinged red or brown, I+ bluish, I_{conc.}+ red. Epihymenium dark green to black, 10 - 15 µm tall. Paraphyses branched and anastomosing, 1.7 - 2 µm, apices (2.5 -) 3 - 4 µm thick. Asci c. 35 - 50 x 10 - 14 µm; tholus max. 7 - 11 µm, min. 2.5 - 4 µm thick; outer amyloid wall layer c. 0.5 µm thick, I+ bluish-brown, I_{conc.}+ red; non-amyloid wall layer c. 0.2 µm thick;



Map 28. Distribution of *Lecidea atromorio* in continental Australia

amyloid cap $0.2 - 0.5 \mu\text{m}$ tall. Spores ellipsoid, $7 - 10 - 12.5 (- 14.5) \times 3 - 4 - 6 \mu\text{m}$.

Pycnidia: immersed. Conidia $5.5 \div 6.7 - 8 \times 1 \mu\text{m}$.

CHEMISTRY:

Cortex K-, P-, C+ rose; medulla K-, P-, C-; excipulum K- (rarely± red), P-, C+ rose.

Two chemotypes observed:

- a) containing gyrophoric acid (major) and lecanoric acid (trace) (13 specimens examined);
- b) containing additional norstictic acid (3 specimens examined).

DISTRIBUTION:

Southern xeric. *L. atromorio* is only known from the Southern Hemisphere. It has been found in semi-arid to arid areas of South Africa

(Cape Prov.), south-eastern and central Australia (N.T., S.A., Qld, N.S.W., A.C.T., Vic.) (map 28) and, according to HERTEL (pers. comm.), in New Zealand (Wellington, Canterbury, Otago), growing on siliceous rock. Hitherto there are no records from Tasmania.

NOTES:

This species is characterized by small, brownish areoles with a hyaline epinecral layer, a non-amyloid medulla, immersed apothecia, a mostly reddish hymenium, spores with a breadth up to 6 μ m, and the production of gyrophoric acid. Morphologically *L. atromorio* closely resembles *L. fuscoatrula*, which differs in that it contains 2'-O-methylmicrophyllinic acid and has an amyloid medulla.

One Australian (Vic.) and two South African samples examined additionally contain norstictic acid. They are not anatomically distinguishable from the norstictic acid deficient strain.

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 167, 185 ("*Lecidea atromorio*") (M)

SPECIMENS EXAMINED:

Northern Territory: Mt Sonder, MacDonnell Ranges, 80 mi W of Alice Springs, [23°35'S, 132°34'E], 13.v.1970, leg. J.A.Brownlie (MEL 37825).

South Australia: South Flinders Ranges, 8 km SW of Wilmington, 32°42'S, 138°02'E, very rocky grazing land with scattered *Casuarina*, 8.v.1985, leg. J.A.Curnow 180 (CBG, H).

Queensland: Bunya Mountains, about 56 km NE of Dalby, NE of the J.S.Fisher Lookout, 26°53'S, 151°37'E, isolated rocks on the ridge, c. 1050 m, 3.ix.1986, leg. J.Hafellner 15495 (hb. Hafellner).

New South Wales: Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4307 (M); -- Kosciusko National Park, 4 km SW of Klandra, 35°54'S, 148°27'E, low outcrops beside track between Selwyn Quarry and Mt Selwyn, c. 1600 m, 20.i.1986, leg. G.Rambold 3721 (M); -- Cooma, 1 km NNW of town, 36°13'S, 149°08'E, low outcrops on slope, in open low *Eucalyptus* woodland beside road to Rosedale, 850 m, 19.i.1986, leg. G.Rambold 3671 (M); -- 5 mi E of Cooma on road to Numeralla, [36°13'S, 149°11'E], on granite outcrops in grassland, 2.x.1967, leg. W.A.Weber & D.McVean (COLO L-47749, L-49069, L-49070); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3616 (M); -- West bank of Lake Jindabyne, 2.5 km NW of Jindabyne, 36°25'S, 148°36'E, granitic boulders in pasture land beside road to Charlottes Pass, c. 900 m, 13.i.1986, leg. G.Rambold 3392 (M); -- 28 km SSW of Jindabyne, near Ingebyra, 36°39'S, 148°30'E, big and small granitic boulders in pasture land beside Buchan - Jindabyne road, c. 950 m, 13.i.1986, leg. G.Rambold 3366 (M).

A.C.T.: Mt Ainslie, Canberra, [35°17'S, 149°13'E], on boulder outcrops in dry sclerophyll woodland, 2.xi.1967, leg. W.A.Weber (COLO); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, exposed summit, on schist rock, 1490 m, 21.i.1984, leg. J.A.Elix 11638 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4053 (M).

Victoria: Kilmore, [37°18'S, 144°57'E], 13.v.1896, leg. F.R.M.Wilson (NSW 155740); Little River, [37°58'S, 144°30'E], on basaltic rock, iv.1887, leg. F.R.M. Wilson (type of *Lecidea fumosella* Müll.Arg., NSW 180243, MEL 6948).

Lecidea capensis Zahlbr.

[nom. nov. for *Lecidea ochroidea* Stiz.]

ZAHLEBRUCKNER, Catal. Lich. Univ. 3: 532 no. 6345 (1925); DOIDGE, Bothalia 5: 269 (1950).

= *Lecidea ochroidea* Stiz.

Ber. Tätigk. (Jahrb.) St. Gallischen Naturwiss. Ges. 1889-90: 159-160 no. 1100 (1891) - nomen illegit., non *Lecidea ochroidea* Ach. 1803.

Type: REP. SOUTH AFRICA: "Saxicola ad Promontorium Bonae Spei", [no date], leg. P. Mac Owan (ZT!, holotype) - [containing 2'-O-methylperlatolic acid].

DESCRIPTION:

Thallus: areolate to squamulose-areolate, up to 110 mm diam., c 0.3 - 1.1 mm thick.

AREOLES: angular to irregularly angular, pale brown to brown, sub-plane to convex, with smooth to nitid surface, c. 0.5 - 1.0 mm, max. 0.8 - 1.3 (- 2.5) mm diam. Cortex up to 70 µm thick; upper cell layer colourless to brown pigmented; hyphae c. 3 - 4 µm diam.; epinecral layer 15 - 60 µm thick. Algal layer c. 55 - 85 µm thick; algal cells c. 10 - 12 µm, max. 14 - 17 µm diam. Medulla I -; hyphae 4 - 4.5 µm thick.

HYPOTHALLUS: black, obvious between the areoles or not developed.

Apothecia: irregularly roundish to round, dispersed to crowded, 10 - 120/cm², sessile to subimmersed, more or less constricted at the base, c. (0.5 -) 0.7 - 1.0 mm, max. 0.8 - 1.8 mm diam. Disc plane to slightly convex, black, matt, sometimes pruinose. Margin distinct and persistent, black, rarely nitid.

EXCIPULUM: max. 40 - 90 µm, lateral of hymenium 40 - 70 µm thick. Ectal zone black-brown to black-green; pigmented zone 10 - 20 µm thick; hyphae 4 - 5 µm diam., with lumina of 1.5 - 2 µm. Inner zone colourless to faintly brown; hyphae 3 - 5 µm diam., with lumina of 1.5 - 2 (- 3) µm. Medullary zone not developed.

HYPOTHECIUM: dark brown, 120 - 300 µm thick; hyphae 3 - 3.5 µm diam.; subhymenial layer colourless, 15 - 35 µm thick.

HYMENIUM: (40 -) 45 - 55 (- 70) µm tall, colourless, pale grey to red, I+ blue to brownish, I_{conc.} + red. Epihymenium greenish-black to brownish-black, 8 - 18 µm tall. Paraphyses rarely branched and rarely anastomosing, 1.8 - 2 µm; apices 3 - 3.5 µm thick. Asci c. 35 - 45 x 7.5 - 10 µm; tholus max. 7 - 9 µm, min. 2.5 - 3 µm thick; outer amyloid wall layer c. 0.2 µm thick, I + brown, I_{conc.} + red; non-amyloid wall layer c. 0.2 µm thick. Spores ellipsoid to oblong-ellipsoid, 7 - 8.6 - 12.3 - 14 x 3 - 3.8 - 4.4 - 4.5 (- 5.5) µm.

Pycnidia: immersed, 100 - 140 x 70 - 100 µm. Conidia 5 - 6 - 8.4 - 11 x c. 0.9 - 1.2 µm.

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

Two chemotypes observed:

- a) containing 2'-O-methylperlatolic acid (80 specimens examined);
- b) containing additional confluent acid (minor or trace) (7 specimens examined).

DISTRIBUTION:

Southern xeric. *L. capensis* occurs only in the Southern Hemisphere, growing on sun-exposed, siliceous rock in semi-arid areas of South Africa (Cape Prov.), Australia (W.A., S.A., N.S.W., A.C.T, Vic.) (map 29) and New Zealand. No reports exist from Tasmania.

NOTES:

The species is characterized by its typically large, areolate thallus, the convex and nitid pale brown to brown areoles with epinecral layer, apothecia with more or less pruinose discs, a non-amyloid medulla and 2'-O-methylperlatolic acid as major lichen substance. All specimens collected in Western Australia belong to the chemical strain containing additional confluent acid, which is lacking in specimens

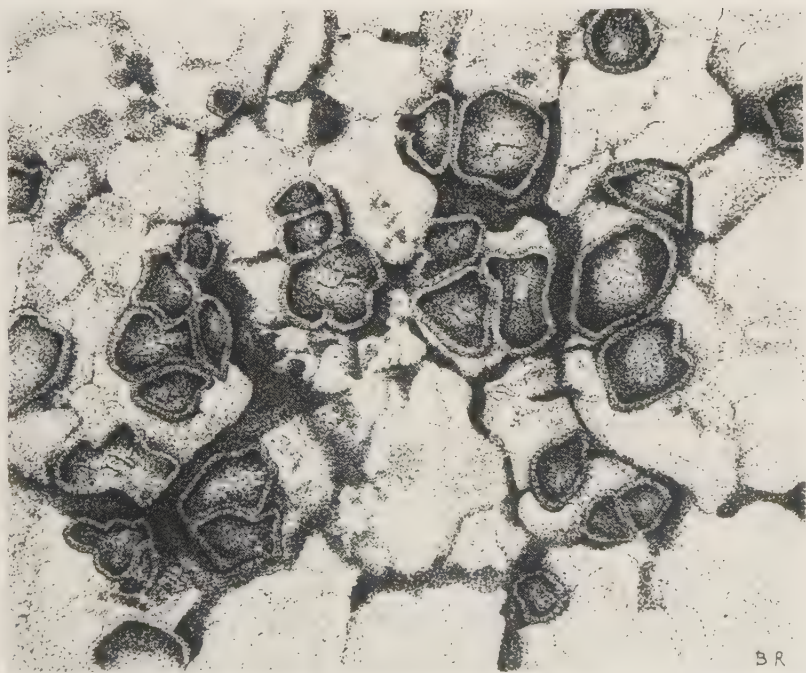
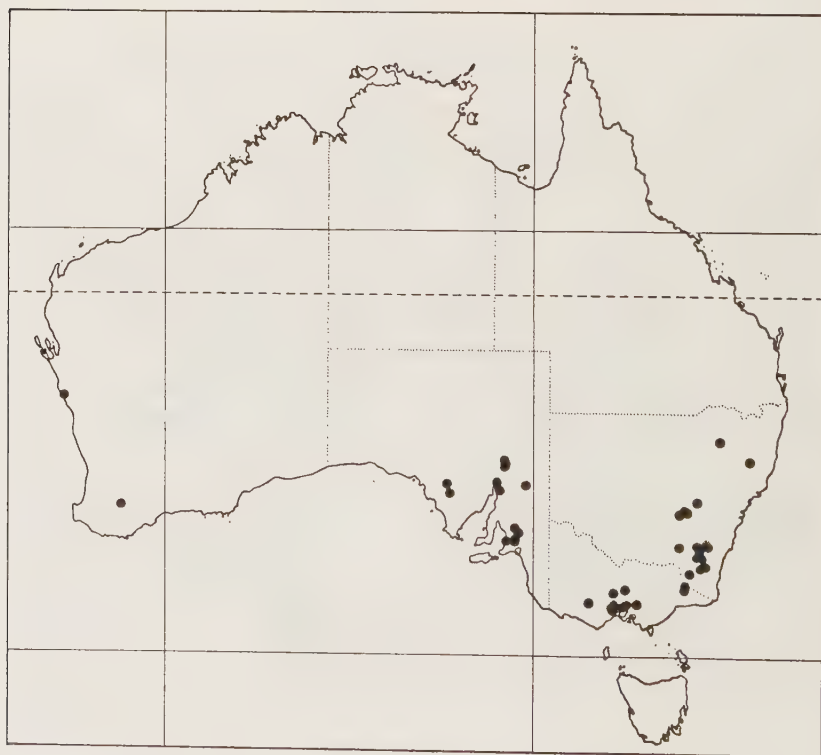


Fig. 16. *Lecidea capensis*. (GR 3382, M) Scale = 1 mm.

from the other areas. No anatomical differences between the two strains could be observed. The specimens from south-eastern Australia are identical chemically and anatomically to the South African type material and other specimens collected there, though they differ morphologically in developing more bullate-areolate thalli. However, better developed South African material needs to be examined to determine the significance of these slight differences.

Australian reports of *L. fuscoatra* (MÜLLER ARGOVIENSIS 1893: 47, ELIX & STREIMANN 1982: 79, FILSON 1988a: 19, 103) - an European species, which has not been found in the Southern Hemisphere as yet - mostly refer to *L. capensis*. *L. fuscoatra* differs in thallus morphology and colour (less bullate and more greyish) as well as chemically (gyrophoric acid as the major constituent). A species with a similar combination of characters to *L. capensis* is *L. tragarum*. For the distinguishing characteristics of both taxa refer to the discussion under the latter.



Map 29. Distribution of *Lecidea capensis* in continental Australia

SPECIMENS EXAMINED:

Western Australia: Hutt River, between Northampton and Port Gregory, [28°12'S, 114°23'E], 28.viii.1987, leg. H.T.Lumbach 5530 d (hb. Lumbach); -- 8 km SE of Woodanilling, 33°36'S, 117°30'E, sandstone boulders in paddock beside Great Southern Highway, 300 m, 3.iv.1986, leg. G.Rambold 5418, 5420, 5424, 5425, 5429, 5431 (M).

South Australia: Flinders Ranges National Park, Parachilna Gorge, 19 km W of Blinman, 31°08'S, 138°31'E, SW exposed rocks beside road, 250 m, 7.iv.1986, leg. G.Rambold 5464 (M); -- Flinders Ranges Lookout 2 km N of Yanyanna Hut, 15 km NW of Wilpena, 31°24'S, 138°35'E, in open grassland with dwarf *Acacia*, 600 m, 29.x.1984, leg. J.A.Elix 17893 (ANUC); -- Flinders Ranges National Park, Bunyeroo Gorge Road, 8 km N of Wilpena, 31°25'S, 138°36'E, rocky ridge in open grassland on rocks, 550 m, 29.x.1984, leg. J.A.Elix 17893 (ANUC); -- Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G.Rambold 5509 (M); -- Olive Grove Station, 14.4 km S of Quorn, [32°25'S, 138°02'E], on rocky hillside, in sheltered position under small rock overhang, 30.x.1970, leg. R.Filson 11989a (MEL); -- Eyre Peninsula Region, Scrubby Peak, 32°31'S, 135°19'E, waterfalls near Scrubby Peak, 21.vi.1977, leg. N.N.Donner 5881 (AD); -- Yunta Hills just SW of Yunta, [32°35'S, 139°34'E], vertical exposures of flaky schist, 19.xi.1967, leg. W.A.Weber & D.McVean (COLO L-50008); -- Flinders Ranges, lower slopes of Mt Remarkable, Melrose, 32°50'S, 138°11'E, in open *Eucalyptus* woodland on sandstone rocks, 500 m, 26.x.1984, leg. J.A.Elix 17749 (ANUC); -- On granite inselberg, Wudinna Hill, Eyre Peninsula, [32°59'S, 135°33'E], 1.1966, leg. D.McVean 6645 (CBG, COLO); -- 100 yards N from main Germein Gorge road, 10 mi E of Port Germein, [33°01'S, 138°0(?)'E], 16.xi.1975, leg. R.Filson 15541, 15543 (MEL); -- Tanunda Creek, 4 mi SW of Angaston, [34°32'S, 139°00'E], decaying granite, 31.xii.1967, leg. R.W.Rogers 1358 (BRIU, COLO); -- Barossa Range, Menglers Hill, 4 km E of Tanunda, 34°32'S, 139°00'E, in pasture land on schist rock, 27.x.1981, leg. J.A.Elix 9207 (ANUC); -- 15 E of Eden Valley along the Pine Hut road, [34°39'S, 139°15'E], on sandstone rocks in pasture land, 305 m, 9.ix.1977, leg. J.A.Elix 3902 (ANUC); -- 15 km E Springton, overlooking Marne River, [34°42'S, 139°14'E], on schist rocks, 335 m, 6.v.1975, leg. J.A.Elix 851 (ANUC, MEL); -- 13.5 km N of Callington, Mt Lofty Ranges, [35°00'S, 139°00'E], in dry pasture land on schist rocks, 30.x.1981, leg. J.A.Elix 9432 (ANUC); -- 1 km W Hallett Cove, [35°04'S, 138°30'E], on quartz rocks in pasture land, 120 m, 13.v.1976, leg. J.A.Elix 2129 (ANUC); -- 1 km W Hallett Cove, [35°04'S, 138°30'E], on calcareous slate, 120 m, 13.v.1976, leg. J.A.Elix 2131 (ANUC); -- Kanmantoo, 40 km SE of Adelaide, 35°04'S, 139°01'E, rocky hillside, 11.viii.1981, leg. M.& H.Mayrhofer 2786 (GZU); -- Summit of hill c. 2 km E of Callington, 47 km SE of Adelaide, 35°07'S, 139°02'E, 11.viii.1981, leg. M.& H.Mayrhofer 2811 (GZU).

New South Wales: Mt Kaputar National Park, W Kaputar Rocks, 30°17'S, 150°09'E, open forest, bare rock, 1450 m, 8.ii.1987, leg. P.Merrotzky 455 (BRIU); -- Mt Kaputar National Park, Repeater Station near Kaputar Rocks Lookout, 30°17'S, 150°09'E, open forest, 1450 m, 8.i.1987, leg. P.Merrotzky 435 (BRIU); -- Mt Kaputar National Park, ridge E of Scutts Hut, 30°20'S, 150°11'E, open forest, 900 m, 2.viii.1986, leg. P.Merrotzky 283 (BRIU); -- Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4279, 4297, 4303 (M); -- Mt Canobolas, 8 km SW of Orange, 33°19'S, 149°00'E, open stunted *Eucalyptus* forest amongst rocky outcrop, 1390 m, 8.viii.1979, leg. H.Streimann 9203 (CBG); -- Summit of Mt Canobolas, 8 km SW of Orange, on volcanic rock on open summit, [33°20'S, 149°00'E], 1426 m, 8.viii.1979, leg. J.A.Elix 6241 (ANUC); -- Summit of Mt Canobolas near Orange, 33°20'S, 149°00'E, on rocks, 1426 m, 1.iv.1978, leg. J.A.Elix 4613 (ANUC); -- Kangaroo State Forest, 16 km S of Gooloogong, [33°40'S, 148°25'E], on moist slate rocks in open woodland, 10.ix.1980, leg. J.A.Elix 8839 (ANUC); -- Weddin Range, 15 km W of Grenfell, 33°54'S, 148°01'E, in *Callitris* -

Eucalyptus woodland, on rocks, 430 m, 17.x.1986, leg. J.A.Elix 17683, 17685 (ANUC); -- Southern Tablelands, Lake George, western shore, 13 km from Bungendore towards Silver Wattle Point, 35°10'S, 149°23'E, hilly to flat rocky foreshore, 680 m, 7.x.1976, leg. D.Verdon 2591 (CBG); -- 3 km E of Bungendore, [35°15'S, 149°27'E], on sandstone rocks, pasture land, 820 m, 23.iii.1977, leg. J.A.Elix 3039 (ANUC); -- Granite Hill, 2 mi N of Adelong, [35°17'S, 148°04'E], on granite rock, 12.v.1968, leg. R.Filson 10888 (MEL); -- Tinderry Range, 9 km E of Michelago along the Captains Flat road, [35°49'S, 149°18'E], along the roadbank on sandstone rocks, 1200 m, 15.xi.1981, leg. J.A.Elix 9610, 9614 (ANUC); -- 10 km E of Cooma, along Numeralla Road, [36°11'S, 149°26'E], granite rocks, 910 m, 19.i.1976, leg. J.A.Elix 1518 (ANUC); -- 5 mi E of Cooma, on road to Numeralla, [36°12'S, 149°15'E], low outcrops, in grassland near stream, 2.x.1967, leg. W.A.Weber & D.McVean (COLO L-47747); -- Cooma, 1 km NNW of town, 36°13'S, 149°08'E, low outcrops on slope, in open low *Eucalyptus* woodland beside road to Rosedale, 850 m, 19.i.1986, leg. G.Rambold 3672 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G.Rambold 3644, 3646, 3647 (M); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G.Rambold 3700 (M); -- Lake Jindabyne, small unnamed peninsula between mouth of Thredbo River and the village of Jindabyne, 36°24'S, 148°37'E, 950 m, 3.iii.1985, leg. H.Hertel 32062 (M); -- West bank of Lake Jindabyne, 2.5 km NW of Jindabyne, 36°25'S, 148°36'E, granitic boulders in pasture land beside road to Charlottes Pass, c. 900 m, 13.i.1986, leg. G.Rambold 3382, 3384, 3387 (M).

A.C.T.: Ginninderra Creek, Latham, 13 km NW of Canberra, 35°12'S, 149°00'E, old grazed grasslands with rock outcrops, scattered outcrop beside stream, 610 m, 18.iii.1979, leg. H.Streimann 7698 (CBG, COLO, M); -- Mt Ainslie, Canberra, [35°17'S, 149°13'E], on low outcrops in dry sclerophyll forest, 2500 ft, 30.ix.1967, leg. W.A.Weber (COLO L-47280); -- Mt Ainslie, Canberra, [35°17'S, 149°13'E], low outcrops in dry sclerophyll forest, 2000 ft, 30.ix.1967, leg. W.A.Weber & D.McVean (COLO L-47372); -- On rocky hillside, 1 km downstream from Casuarina Sands, porphyry boulders, 530 m, 13.vi.1975, leg. J.A.Elix 924 (ANUC); -- 4.5 km S of Tharwa, Gudgenby River Gorge, 35°45'S, 148°58'E, 660 m, 17.x.1981, leg. V.Wirth 11070 (STU).

Victoria: 2 km NE of Suggan Buggan, Eastern Gippsland, [36°56'E, 148°22'E], on granite rocks in open woodland, 600 m, 21.ix.1978, leg. J.A.Elix 4973 (ANUC); -- Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3331 (M); -- Mac Killop Bridge, 14 km E of Wulgulmerang, 37°05'S, 148°25'E, 200 m, 12.i.1986, leg. G.Rambold 3356 (M); -- Tallarook, [37°06'S, 145°06'E], on rocks in dry sclerophyll forest, 29.vii.1978, leg. J.A.Elix 4880 (ANUC); -- Kyneton, [37°15'S, 144°27'E], 10.v.1897, leg. F.R.M.Wilson (NSW 155885); -- Streatham, [37°41'S, 143°04'E], [no date], leg. F.R.M.Wilson (NSW 155822); -- Melbourne, Mt Donna Buang, [37°42'S, 145°41'E], iii.1963, leg. P.W.James (BM); -- Rowsley, [37°43'S, 144°25'E], 27.xii.1901, leg. R.A.Bastow (MEL 6958); -- Yarra Bend, [37°44'S, 145°09'E], sandstone rock, 13.x.1985, leg. F.R.M.Wilson (NSW 180242); -- Kew, [37°48'S, 145°01'E], on sandstone rock, 6.viii.1885, leg. F.R.M.Wilson (NSW 155928); -- Yarra Bend, [37°48'S, 145°00'E], on basalt, 6.viii.1886, leg. F.R.M.Wilson (NSW 155927); -- Brisbane Ranges, Little River Gorge, c. 25 km S of Bacchus Marsh, 37°51'S, 144°22'E, 18.x.1981, leg. H.Mayrhofer 3016 (GZU); -- Little River, [37°58'S, 144°30'E], on basaltic rock, iv.1887, leg. F.R.M.Wilson (NSW 155925); -- Point Wilson, 15 km NE of Geelong, [38°06'S, 144°30'E], iii.1980, leg. A.Geddes (MEL 1029143, 1029140, 1029398); -- Greengrove, Kalkado, iii.1897, leg. F.R.M.Wilson (MEL 6955); -- Braybrook Junction, 15.x.1900, leg. R.A.Bastow (MEL 6957); -- Yalla (Yalla-y-poorra), 1895, leg. F.R.M.Wilson 1126 (COLO ex G).

Lecidea fuscoatrula Nyl.

[*"Lecidea fusco-atrula "*], NYLANDER, Lich. Nov. Zeland.: 106 (1888); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 586 no. 6441 (1925); HERTEL, Beih. Nova Hedwigia 79: 418 (1984); GALLOWAY, FL. New Zeal. Lich.: 231 - 232 (1985).

Type: NEW ZEALAND: South Island: Otago, Kaikera Hill near Dunedin, on basaltic boulders, 1861, leg. L. Lindsay (H-Nyl. 15369), lectotype - designated in HERTEL (1984) - [not analyzed chemically].

DESCRIPTION:

Thallus: areolate, up to 60 mm diam., 0.1 - 0.4 (- 0.7) mm thick.

AREOLES: angular to roundish, pale brown to brown, olivaceous, plane, with smooth to nitid surface, c. 0.4 - 0.5 (- 0.7) mm, max. 0.7 - 1.3 mm diam. Cortex 15 - 30 μ m thick; upper cell layer brownish to brown pigmented; hyphae c. 3 - 4 μ m diam.; epinecral layer 5 - 50 μ m thick. Algal layer c. 50 - 90 μ m thick; algal cells c. 9 - 13 μ m, max. 10 - 16 μ m diam. Medulla I+ violet; hyphae c. 4 (- 6) μ m thick.

HYPOTHALLUS: black, obvious between the areoles and at the thallus margin.

Apothecia: angular to roundish, crowded to scattered, 140 - 300/cm², immersed to subimmersed, c. 0.4 - 0.5 mm, max. 0.5 - 0.8 mm diam. Disc plane to subconcave, black to greyish-black, matt, occasionally pruinose. Margin at first more or less distinct, later vanishing, grey, pale grey to black, matt.

EXCIPULUM: max. 25 - 50 μ m, lateral of hymenium 25 - 50 μ m thick, mostly reduced. Ectal zone dark green, grey to black-brown; pigmented zone 10 - 20 μ m thick; hyphae 3 - 4.5 μ m diam., with lumina of 1 - 2 μ m. Inner zone colourless to pale grey-brown; hyphae 3 - 4.5 μ m diam., with lumina of 1.2 - 2 μ m. Medullary zone developed.

HYPOTHECIUM: dark brown to brown, 55 - 170 μ m tall; hyphae 3.5 - 4.5 μ m diam.; subhymenial layer colourless, 7 - 30 μ m thick.

HYMENIUM: 30 - 65 μ m tall, red to colourless, I+ bluish, I_{conc.}+ red. Epihymenium grey to black, 10 - 15 μ m tall. Paraphyses mostly branched and anastomosing, 1.6 - 2 μ m, apices 2.2 - 4 μ m thick. Asci rarely developed, c. 30 - 45 x 8 - 12 μ m, outer amyloid wall layer I+ brown, I_{conc.}+ red. Spores ellipsoid, 8 - 10.5 x 4 - 5 μ m.

Pycnidia: immersed. Conidia 5 - 6.5 - 7.7 - 10 x 1 μ m.

CHEMISTRY:

Cortex K- (K+ red), P- (P $\pm$ orange), C-; medulla K-, P-, C-; excipulum K-, P-, C-.

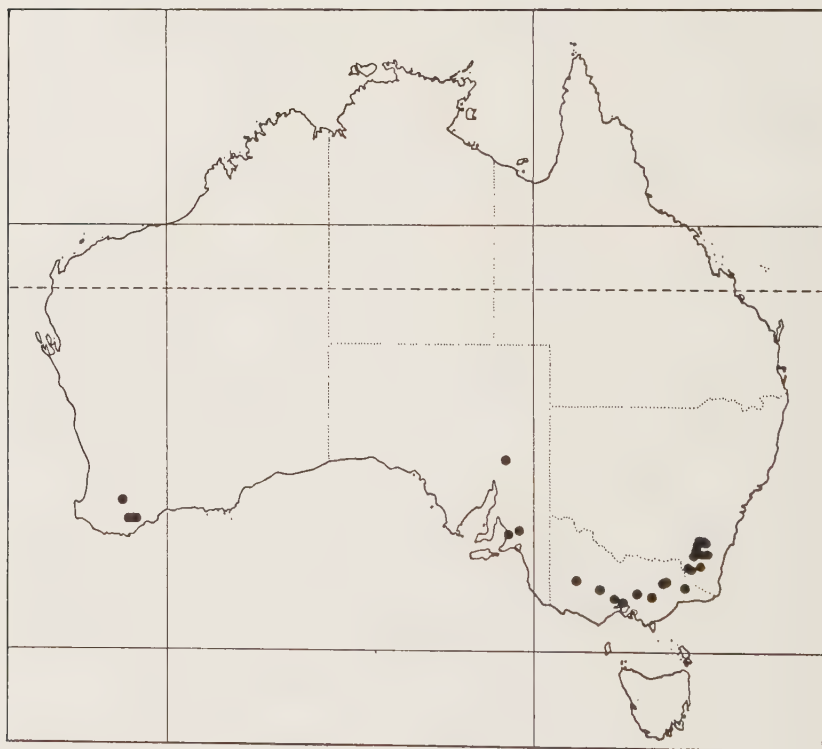
Five chemotypes observed:

- a) containing 2'-O-methylmicrophyllinic acid (28 specimens examined);
- b) containing additional norstictic acid (minor or trace) (20 specimens examined);
- c) containing additional stictic acid (minor) and norstictic acid (trace) (5 specimens examined);

- d) containing confluent acid (major) and 2'-O-methylmicrophyllinic acid (3 specimens examined);
- e) containing confluent acid (major) and norstictic acid (2 specimens examined).

DISTRIBUTION:

Southern xeric. *L. fuscoatrula* occurs in South Africa (Cape Prov.), Australia (W.A., S.A., N.S.W., A.C.T., Vic.) (map 30) and New Zealand, growing on siliceous rock. Hitherto there are no reports from Tasmania. The distribution resembles that of the very similar *L. atromorio*, which, however, has not been found in W.A.



Map 30. Distribution of *Lecidea fuscoatrula* in continental Australia

NOTES:

This species resembles *L. atromorio* in that both species have a brown thallus with small areoles and immersed apothecia. *L. fuscoatrula* differs in having an amyloid medulla and in its chemism (*L. atromorio* contains gyrophoric acid as major substance). The different chemotypes of *L. fuscoatrula* are not distinguished anatomically, morphologically or geographically.

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 189 ("*Lecidea fuscoatrula*")

SPECIMENS EXAMINED:

Western Australia: 8 km SE of Woodanilling, 33°36'S, 117°30'E, sandstone boulders in paddock beside Great Southern Highway, 300 m, 3.iv.1986, leg. G. Rambold 5416, 5420, 5426, 5430 (M); -- Stirling Range National Park, Mt Hassell, 34°23'S, 118°04'E, sandstone rocks on summit, c. 848 m, 2.iv.1986, leg. G. Rambold 5374, 5385 (Hertel, Lecideac. Exs. no. 189, M); -- Stirling Range National Park, Bluff Knoll, 34°23'S, 118°15'E, exposed sandstone outcrops on peak SW of summit, c. 1000 m, 3.iv.1986, leg. G. Rambold 5390, 5397, 5403 (M); -- Stirling Range National Park, Baby Barnett Hill, 34°24'S, 117°48'E, low sandstone boulders on S slope of hill, 450 m, 1.iv.1986, leg. G. Rambold 5296, 5297 (M); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, leg. G. Rambold 5322, 5325, 5347, 5351, 5365 (M).

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G. Rambold 5486, 5496, 5514, 5537, 5538, (M); -- Fred Rattei's Scrub, 7 km W of Springton, 34°44'S, 139°17'E, 500 - 530 m, 12.viii.1981, leg. M. & H. Mayrhofer 2809 (GZU); -- Mario Rocks, headland of St Vincens Gulf just S of Brighton (Adelaide), [35°00'S, 138°40'E (?)], 17.xi.1967, leg. W.A. Weber & D. McVean (COLO L-49981); -- 4 km W of Carey Gully, along the Forest Range Road, on rocks in dry sclerophyll forest, 456 m, 21.xii.1976, leg. J.A. Elix 2818 (ANUC).

New South Wales: 3 km E of Bungendore, [35°17'S, 149°25'E], rocky hillside, on sandstone rocks in pasture land, 820 m, 23.iii.1977, leg. J. A. Elix 3040 (ANUC); -- Gourcock Range, along Cowangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G. Rambold 3971 (M); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G. Rambold 3914, 3922 (M); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Klandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G. Rambold 3742, 3745, 3751, 3759, 3760 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G. Rambold 3654 (M); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G. Rambold 3691, 3698 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G. Rambold 3622, 3638 (M); -- Mt Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, 1620 - 1680 m, 3.iii.1985, leg. H. Hertel 31831, 31833 (M); -- Kosciusko National Park, Diggers Creek, near road to Charlottes Pass, 36°22'S, 148°29'E, granite boulders above a little lake, c. 1500 m, 3.iii.1985, leg. H. Hertel 32046, 32047 (M); -- West bank of Lake Jindabyne, 2.5 km NW of Jindabyne, 36°25'S, 148°36'E, granitic boulders in pasture land beside road to Charlottes Pass, c. 900 m, 13.i.1986, leg. G. Rambold 3376, 3381 (M).

A.C.T.: Black Mountain, 5 km NW of Canberra, 35°16'S, 149°06'E, dry sclerophyll forest on south western slopes, on semi-exposed rock be-

side seasonal stream, 780 m, 15.vi.1980, leg. H.Streimann 10307 (CBG); -- Mt Ainslie, Canberra, [35°17'S, 149°13'E], on low outcrops in dry sclerophyll forest, 2500 ft, 30.ix.1967, leg. W.A.Weber (COLO L-47281); -- Blue Range, 24 km WNW of Canberra, 35°18'S, 149°51'E, 1100 m, 25.iv.1980, leg. H.Streimann 10192 (CBG); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, rhyolite rocks, 1420 m, 27.i.1986, leg. G.Rambold 4069 (M); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m, 21.i.1984, leg. P.W.James (BM); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4009, 4021, 4029, 4048 (M).

Victoria: Red Bluff, about 50 mi NW of Kaniva, [35°45'S, 141° (?)'E], on sandstone rock, 17.xi.1971, leg. R.Filson 14338 (MEL); -- Flat Rock, Northern Grampians, 25 km SE of Horsham, 36°54'S, 142°22'E, 17.viii.1981, leg. M.& H. Mayrhofer 2982 (GZU); -- Bogong Highplains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, c. 1600 m, 26.ii.1985, leg. H.Hertel 31446 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, on basalt, 3.i.1986, leg. G.Rambold 3048, 3051, 3057, 3060 (M); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3104 (M); -- Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3327 (M); -- 6 km SSW of Talbot, 37°14'S, 143°41'E, crest of small ridge in light *Eucalyptus* forest, c. 320 m, 19.v.1977, leg. T.B.Muir 5492 (MEL); -- Buxton, Cathedral Range, Sugarloaf Peak, 37°24'S, 145°45'E, *Eucalyptus* forest, 11.x.1081, leg. V. Wirth 10732 (STU); -- Mt Crinoline, 43 mi N of Traralgon, [37°34'S, 146°32'E], vi.1963, leg. D.H.Ashton (BM); -- 8 km W of Melton, 1 km N of Anthony's cutting, on the Djerriwarrah creek, 37°39'S, 144°31'E, open *Eucalyptus* forest, 100 m, 10.x.1981, leg. V.Wirth 10967 (STU); -- Kew, [37°48'S, 145°01'E], 10.iii.1887, leg. F.R.M.Wilson (NSW 155788); -- Melbourne, Hanging Rock, [37°49'S, 144°58'E], 13.ix.1987, leg. H.T. Lumbsch 5663 r (hb. Lumbsch); -- Mt Fainter South, Bogong High Plains, 6125 ft, 26.i.1967, [confl.], leg. R.Filson 9597 (MEL).

Lecidea ochroleuca Pers.

PERSOON in GAUDICHAUD, Voyage Uranie, Botan.: 193 (1826); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 644 no. 6606 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 53 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); Checklist Austr. Lich. 2. ed.: 62 (1986); Austr. Fl. Fauna Ser. 4: 125 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988). Protologue: "Novae Hollandiae ora occidentali (Baie des Chiens-Marins), obtegit rupes" [= Shark Bay] - original collection not located.

Neotype: AUSTRALIA: Western Australia: Wallangering, [30°50'S, 120°11'E], 24.xi.1891, leg. R.Helms 72 (MEL 6898) - designated here - [containing gyrophoric acid].

= *Lecidea confluentula* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Flora 55: 536 (1872); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 541 no. 6367 (1925); 8: 336 (1932); HERTEL, Willdenowia 6: 238 (1971); HERTEL, Decheniana 127: 59, 64 (1975); Mitt. Bot. Staatssamml. München 17: 172 - 173 (1981).

Type: FRANCE: Dept. Haute Savoie: "am Eldorado der Salève-Höhe" (S of Geneve), 22.ix.1872, leg. J. Müller-Argovienensis (G!, holotype) - [containing gyrophoric acid].

= *Lecidea planata* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Flora 70: 61, 118 (1887); MÜLLER ARGOVIENSIS, Hedwigia 31: 197 (1892); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 670 no. 6648 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); HERTEL, Beih. Nova Hedwigia 79: 422, 486 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 63 (1986); FILSON, Austr. Fl. Fauna Ser. 4: 127 (1986); Checklist Austr. Lich. 3. ed.: 19, 105 (1988).

Type: AUSTRALIA: South Australia: "St. Vincents Gulf", [no date], comm. F. v. Müller [leg. J.G.Tepper (?) - vide FILSON 1986b: 127], (G!, lectotype; M!, isoelectotype - designated in HERTEL 1984 = holotype of *L. plana* Kremp.) - [containing gyrophoric acid].

= *Lecidea plana* Kremp.

KEMPELHUBER, Verhandl. K. K. Zool.-Bot. Ges. Wien 30: 340 (1880) - nomen illegit., non *Lecidea plana* (Lahm) Nyl. 1872; KREMPELHUBER in MÜLLER, Fragm. Phytogeogr. Austr. 11, suppl.: 73 (1880).

Type: AUSTRALIA: South Australia: "St. Vincents Golf, auf Sandboden", [no date], comm. F. v. Müller [leg. J.G.Tepper (?) - vide FILSON 1986b: 127], (M!, holotype = isoelectotype of *L. planata* - designated in HERTEL 1984) - [containing gyrophoric acid].

= *Psora endochlora* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Flora 71: 204 - 205 (1888); FILSON, Checklist Austr. Lich. 1. ed.: 96 (1983); Checklist Austr. Lich. 2. ed.: 124 (1986); Austr. Fl. Fauna Ser. 4: 248 (1986).

Type: AUSTRALIA: Victoria: NW Lake Albacutya, [no date], leg. C. French (G!, holotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: verrucose-areolate, up to 60 mm diam., up to c. 0.3 mm thick. **AREOLES:** irregularly angular, white to grey, plane to subconvex, with rough to smooth surface, c. 0.5 - 0.7 mm, max. 0.8 - 1.2 mm diam. Cortex 25 - 40 µm thick; upper cell layer not pigmented or grey; hyphae c. 3 - 3.5 µm diam.; epinecral layer not developed. Algal layer c. 40 - 100 µm thick; algal cells c. 8 - 10 µm, max. c. 12 µm diam. Medulla I -; hyphae c. 3 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed to crowded, 20 - 70/cm², sessile, c. 0.7 - 1.3 mm, max. 0.9 - 2 mm diam. Disc plane to subconvex, black, matt, rarely pruinose. Margin at first mostly distinct, later mostly vanishing, black, matt.

EXCIPULUM: max. 55 - 120 µm, lateral of hymenium 45 - 95 µm thick. Ectal zone black-brown to dark green-brown; pigmented zone 10 - 20 µm thick; hyphae 3 - µm diam., with lumina of c. 1 - 2 µm. Inner zone colourless to pale brown; hyphae c. 3.5 - 6 µm diam., with lumina of 2 - 3.5 µm. Medullary zone usually absent.

HYPOTHECIUM: dark brown, 120 - 160 (- 200) µm thick; hyphae 3.5 - 4.5 µm diam.; subhymenial layer weakly tinged brown to green, 15 - 30 µm tall.

HYMENIUM: 60 - 95 µm tall, colourless to pale green, I± bluish-brown, I_{conc.} + red-brown. Epihymenium olivaceous, c. 10 µm tall. Paraphyses branched and anastomosing, 1.7 - 2 µm, apices c. 2.2 - 3 (- 4) µm thick. Asci c. 60 - 75 x 10 - 12 µm; tholus max. c. 9 µm, min. c. 3 µm thick; outer amyloid wall layer c. 1 µm thick, I+ bluish-brown, I_{conc.} + red-brown; non-amyloid wall layer c. 0.5 µm thick. Spores ellipsoid, 7 - 8.9 - 16.6 - 20 x 5 - 5.1 - 7 - 8 µm.

Pycnidia: immersed. Conidia 6 - 8 - 10 x 1 µm.

CHEMISTRY:

Cortex K-, P-, C± rose; medulla K-, P-, C-; excipulum K-, P-, C± rose.

Two chemotypes observed:

- containing gyrophoric acid (major) and lecanoric acid (traces?) (60 specimens examined: 51 terricolous, 9 saxicolous);
- no lichen substances found (66 specimens examined).

DISTRIBUTION:

Xeric. In the Southern Hemisphere, *L. ochroleuca* is distributed in semi-arid to arid regions of Australia (W.A., S.A., Qld, N.S.W., A.C.T., Vic.) (map 31). No records exist from Tasmania, New Zealand, and South Africa. The species was described as *L. confluentula* from Europe and seems to be very rare in the Northern Hemisphere. Furthermore, it is reported from Venezuela, growing at 4700 m (HERTEL 1971), and from Greenland (HERTEL 1981b). Considering the ecology of *L. ochroleuca*, these two reports (under the name *L. confluentula*) probably refer to another species not known to the author.

NOTES:

L. ochroleuca is the only representative of *Lecidea* s.str. known, which grows mainly on sandy soil. The species is very common in dry areas where it frequently occurs on termite mounds. It is very similar to *L. terrena*, which has also a wide distribution within Australia, but is less frequent in W.A. The latter species usually colonizes rocks and typically contains confluent acid. The two species are both morphologically and anatomically (including the spore size) very similar (fig. 17 p. 179 and 20, p. 192). The majority of the terricolous specimens examined contained gyrophoric acid or lacked lichen substances but most of the saxicolous specimens examined contained confluent acid

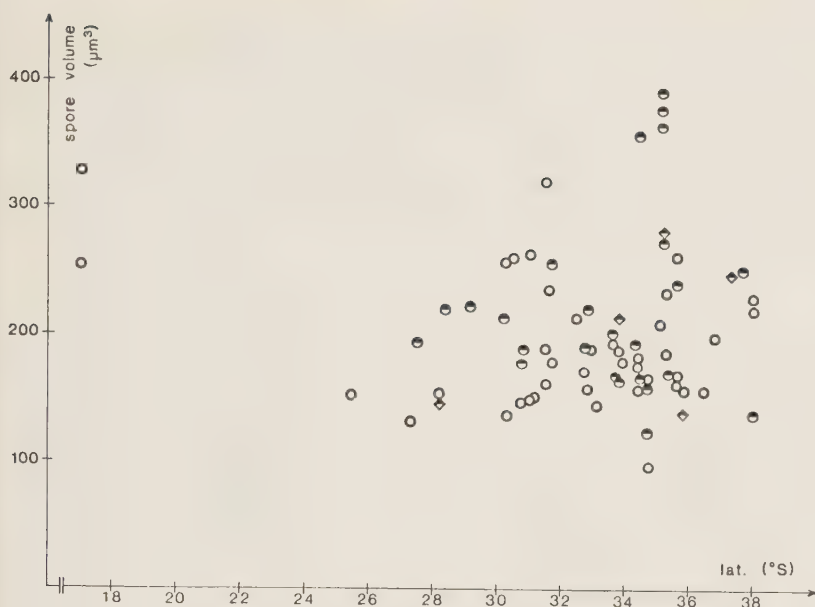


Fig. 17. Spore volume - geographical latitude diagram of *Lecidea ochroleuca* in continental Australia: terricolous, containing gyrophoric acid [$\circ$], terricolous, containing no substances [$\square$], saxicolous, containing gyrophoric acid [$\diamond$].

(fig. 18a). This correlation and the differing distribution patterns (map 31, 33) indicated that the two taxa should be considered as different species. Specimens containing gyrophoric acid are regarded as belonging to *L. ochroleuca*, those containing confluent acid, as *L. terrena*. Specimens lacking secondary metabolites preliminarily were assigned to one of the two species according to the substratum: the terricolous specimens to *L. ochroleuca*, the saxicolous ones to *L. terrena* (fig. 18b).

Only two saxicolous and terricolous lecideoid species were hitherto known from the area around the type locality of *L. ochroleuca* at Shark Bay in Western Australia: *Parapropidia glauca* and *Lecidea planata* (= *Lecidea confluentula*). The original description of *L. ochroleuca* (... "Le *lecideia ochroleuca* ressemble beaucoup au *Lecidea ochrochlora*, Ach.; mais ses scutelles sont plus petites, nullement convexes, et ont un bord distinct."), is more applicable to *Lecidea planata* than to *P. glauca*, which has relatively large, more or less convex apothecia usually with vanishing margins. The chosen neotype, also from Western Australia, corresponds well with the original diagnosis, except that it grows on sandy soil instead on rock. However as shown in fig. 18, all three chemical races of the *L. ochroleuca* - *L. ter-*

rena - group are found on both substrates. The cited material from MEL collected in the area around the type locality, is too poorly developed to be selected as a neotype. For this reason, a specimen collected near Wallangering (W.A.) by R.Helms is selected as neotype.

Such a neotypification of *L. ochroleuca* refers this common xerophilous Australian species to an old Australian name, while *Lecidea confluentula*, the oldest available name for which type material has been located, is based on European material.

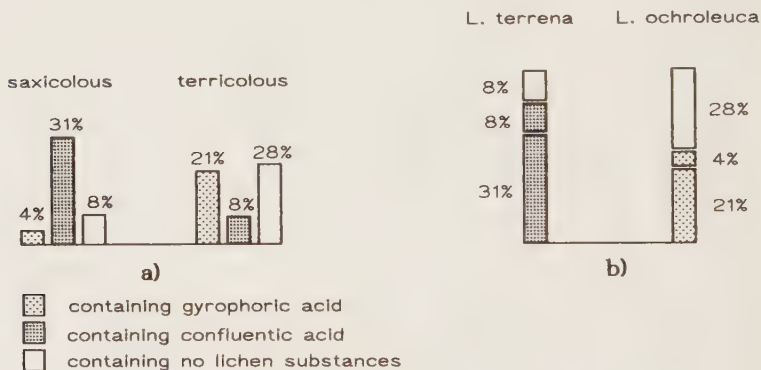


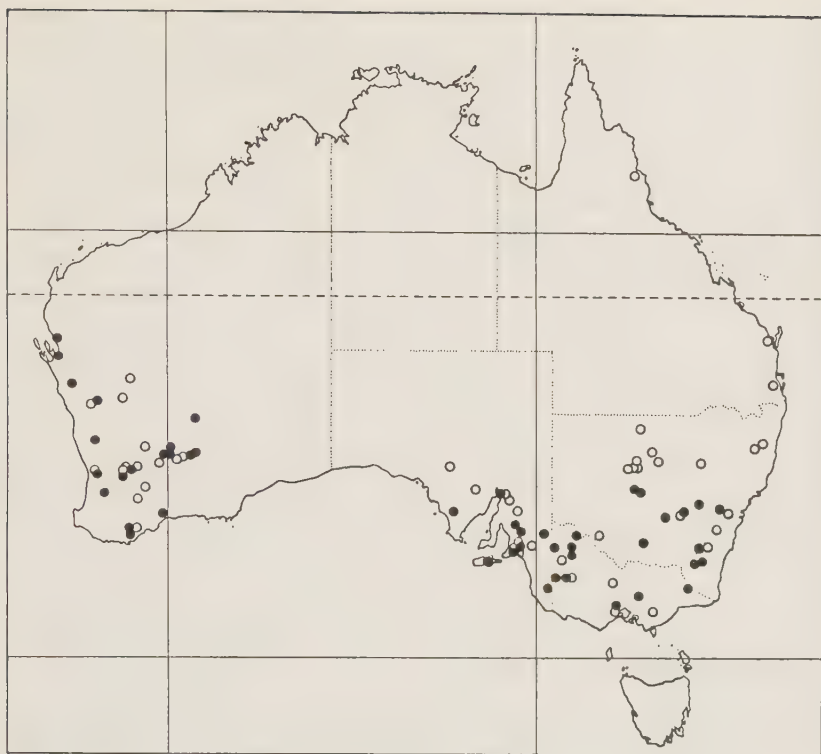
Fig. 18. a) The substratum preference of the three chemotypes (containing confluent acid or gyrophoric acid or no lichen substances) in the *Lecidea ochroleuca* - *L. terrena* - complex; b) the species concept of *L. ochroleuca* and *L. terrena* with regard to chemism and substratum preference

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 207 ("*Lecidea confluentula*") (M)

SPECIMENS EXAMINED:

Western Australia: 45 mi SSE of Canarvon, NW Coast Highway, [25°25'S, 114°00'E], 20.viii.1965, [gyr.], leg. A.C.Beauglehole 14061 (MEL); -- 2 km W of Hamelin Pool, 26°14'S, 114°03'E, soil surface in low arid *Acacia* woodland, 23.viii.1973, [gyr.], leg. R.W.Rogers 1335 (BRIU); -- 30 km SW of Tuckanarra, 27°21'S, 117°56'E, soil surface in arid *Acacia aneura* woodland, 22.viii.1973, [no subst.], leg. R.W.Rogers 1248 (BRIU); -- 138 km N of Geraldton, 27°30'S, 114°43'E, soil surface in arid low *Eucalyptus* woodland, 24.viii.1973, [gyr.], leg. R.W.Rogers 1361 (BRIU); -- 30 km W of Mt Magnet, 28°11'S, 117°33'E, soil surface in arid *Acacia aneura* woodland, 22.viii.1973, [no subst.], leg. R.W.Rogers 1272 (BRIU); -- 50 km W of Yalgoo, 28°21'S, 116°09'E, soil surface in an arid *Acacia* scrub with *Borya* sp. in the understorey, 23.viii.1973, [gyr.], leg. R.W.Rogers 1302 (BRIU); -- 83 km W of Yalgoo, 28°24'S, 115°50'E, soil surface in low *Eucalyptus* woodland,



Map 31. Distribution of *Lecidea ochroleuca* in continental Australia
(containing gyrophoric acid [●], containing no lichen substances [○])

23.viii.1973, [no subst.], leg. R.W.Rogers 1317 (BRIU); -- 50 km S of Leonora by Kalgoorly Road, 29°09'S, 121°27'E, soil surface in a low arid *Eucalyptus* woodland, 21.viii.1973, [gyr.], leg. R.W.Rogers 1191 (BRIU); -- 10 km S of Marchagee, 30°10'S, 116°03'E, soil in mediterranean *Eucalyptus* woodland with a *Borya* understorey, c. 300 m, 25.viii.1973, [gyr.], leg. R.W.Rogers 1397 (BRIU); -- Wallangering, [30°30'S, 120°11'E], 21.xi.1891, [gyr.], leg. R.Helms 58 (MEL 6897); -- 19 mi E of Bonnie Rock, [30°32'S, 118°43'E], 27.x.1972, [no subst.], leg. B.B.Lamont (PERTH); -- Near Kalgoorlie, [30°45'S, 121°28'E], 1982, [gyr.], leg. M.F. Day (ANUC); -- Koolyanobbing, 30°48'S, 119°45'E, on soil in the open, 21.x.1967, [gyr.], leg. G.C.Bratt 67/505 (HO); -- Wallangering, [30°50'S, 120°11'E], 24.xi.1891, [gyr.], leg. R.Helms 72 (neotype of *L. ochroleuca*, MEL 6898); -- Great Eastern Highway, 23 km E of Coolgardie, 30°52'S, 121°15'E, soil surface in arid low *Eucalyptus* woodland with *Eremophila* and *Maireana* shrubs, 20.viii.1973, [gyr.], leg. R.W.Rogers 1155 (BRIU); -- Great Eastern Highway, 30 km W of Coolgardie, 31°02'S, 120°50'E, soil surface in an arid low *Eucalyptus*-*Eremophila* woodland, 20.viii.1973, [no subst.], leg. R.W.Rogers 1134 (BRIU); -- 20 mi W of Bulla Bulling, [31°09'S, 120°33'E], on soil in eucalypt woodland, 9.vii.1972, [no subst.], leg. N.Sammy 820488, 820492 (PERTH); -- C. 86 km W of Coolgardie, 31°12'S, 120°30'E, on soil in the open, 21.x.1967, [no subst.], leg. G.C.Bratt 67/519 (HO); -- Great Eastern Highway, 25 km E of Southern Cross, 31°17'S, 119°35'E, soil surface in a semi-arid

Eucalyptus-Melaleuca woodland, 19.viii.1973, [no subst.], leg. R.W.Rogers 1096, 1099 (BRIU); -- 48 km E of Merredin, 31°29'S, 118°17'E, 314 m, 21.x.1967, [no subst.], leg. G.C.Bratt 67/501 (HO); -- [no subst.], leg. G.C.Bratt 67/501 (HO); -- 14 mi NE of Tammin, [31°32'S, 117°40'E], sandy soil, 4.ix.1966, [no subst.], leg. B.Main 469 (MEL); -- Great Eastern Highway, 1 km E of Doodlakine, 31°35'S, 117°56'E, soil surface in semi-arid *Hakea-Eucalyptus* woodland, 19.viii.1973, [gyr.], leg. R.W.Rogers 1037 (BRIU); -- Great Eastern Highway, 5 km E of Tammin, 31°38'S, 117°31'E, 19.vii.1973, [no subst.], leg. R.W.Rogers 1022 (BRIU); -- Great Eastern Highway, 3 km W of Cunclerin, 31°39'S, 117°13'E, on soil surface in heavily grazed mediterranean *Eucalyptus* woodland, 19.viii.1973, [gyr.], leg. R.W.Rogers 1008 (BRIU); -- Bullsbrook, [31°40'S, 115°59'E], on ant nest, v.1933, [no subst.], leg. A.M.Baird (MEL 7241); -- John Forrest National Park, 26 km E of Perth, [31°43'S, 116°05'E], 20.x.1982, [gyr.], leg. J.A.Elix 10496 (ANUC); -- Quairading to York road, 8 mi W of Dahgin, [32°00'S, 117°27'E], *Eucalyptus* thicket, on earth, possibly old termite mound, 20.ix.1966, [gyr.], leg. R.Filson 8953 (MEL); -- 8 km W of Hyden, 32°27'S, 118°47'E, on soil in light shelter, 19.ix.1967, [no subst.], leg. G.C.Bratt 67/335 (HO); -- Boddington, [32°48'S, 116°28'E], viii.1945, [gyr.], leg. A.M.Baird (MEL 7239); -- Lake Grace North, 33°06'S, 118°20'E, on soil in light shelter, 9.x.1967, [no subst.], leg. G.C.Bratt 67/319 (HO); -- Jerramungup to Ravensthorpe road, at the West River Crossing, [33°43'S, 119°45'E], sandy loam along E side of river bank, 3.x.1966, [gyr.], leg. R.Filson 9157 (MEL); -- Stirling Ranges, slope of Bluff Knoll, [34°23'S, 118°15'E], in mixed eucalypt scrub on termite mound, 500 m, 25.x.1982, [no subst.], leg. J.A.Elix 10657 (ANUC); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, [gyr., sax], leg. G.Rambold 5344 (M); -- Porongorup Range, [34°42'S, 117°53'E], 10.viii.1958, [gyr.], leg. E.Walter L29 (M).

South Australia: 40 mi (65 km) S of Kingoonya, [31°33'S, 135°20'E], 23.v.1967, [no subst.], leg. R.W.Rogers 1233 (AD); -- Eyre Peninsula, Uno Range, SE end of the range, on the SE side near Harries Bluff, 32°42'S, 136°45'E, rocky slopes covered by various shrubs and trees, 23.ix.1981, [no subst.], leg. N.N.Donner 8766 (AD); -- Southern Flinders Ranges, Mt Remarkable National Park, north-western part of national park, 32°50'S, 138°04'E, 6.viii.1974, [gyr.], leg. N.N.Donner 4986C (COLO); -- Hawker - Quorn road, 5 km SSW of Hawker, 32°56'S, 138°24'E, 8.viii.1985, [no subst.], leg. J.A.Curnow 157 (CBG); -- 5 mi N of Jamestown, [33°08'S, 138°36'E], 28.x.1966, [no subst.], leg. R.W.Rogers 692 (AD); -- Eyre Peninsula, Hundred of Blessing, c. 8 km S of Bascombe Well Homestead (B.W.H. is c. 25 km WSW of Lock), [33°40'S, 135°30'E], 5.x.1967, [gyr.], leg. N.N.Donner (MEL 27386); -- [no subst.], leg. N.N.Donner 2268 (AD); -- Murray Region, near Canegrass South, 80 km NW of Morgan (M. is c. 145 km NE of Adelaide), [33°42'S, 139°00'E], 17.v.1967, [no subst.], leg. R.W.Rogers 1089 (AD); -- 4 km E of Chinamans Well, Yorke Peninsula, 5 m, 1.ix.1977, [no subst.], leg. J.A.Elix 3787 (ANUC); -- Loveday, [34°17'S, 140°25'E], 28.v.1943, [no subst.], leg. E.Gauba 26 (MEL 7249, UPS ex MEL); -- Northern Lofty, Kapunda, 34°21'S, 138°55'E, 11.iv.1966, [gyr.], leg. R.W.Rogers 339 (AD); -- Kapunda, Show Grounds, [34°21'S, 138°55'E], 11.iv.1966, [gyr.], leg. R.W.Rogers 399 (MEL); -- Mt Lofty Ranges, Waterfall Gully, 30.ix.1965, [gyr.], leg. A.C.Beaglehole 15066 (MEL); -- Casey's Gully, Mt Lofty Ranges, 26.xi.1972, [gyr.], leg. R.D.Seppelt 624 (MEL); -- 15 km E of Eden Valley, along the Pine Hut road, [34°37'S, 139°14'E], on soil in pasture land, 9.ix.1977, [gyr.], leg. J.A.Elix 3889 (ANUC); -- 8 mi E of Springton, [34°43'S, 139°13'E], 1100 ft, 15.x.1974, [no subst.], leg. J.A.Elix 466 (ANUC); -- 8 km E of Springton, [34°43'S, 139°10'E], 15.xii.1976, [gyr.], leg. J.A.Elix 2755 (MEL); -- 20 mi (32 km), S of Loxton, [34°44'S, 140°34'E], 11.v.1966, [gyr.], leg. R.W.Rogers 407 (AD, BRIU); -- St. Vincent's Gulf, [no date], [gyr.], leg. ? J.G.Tepper, "comm. F.v. Mueller" (type of *Lecidea planata* Müll.Arg., G); -- Southern Lofty Region, c. 2 km E of Kanmantoo, [35°05'S, 139°02'E], soil among stones on hillside, 4.xi.1968, [no subst.], leg. R.W.Rogers 1527

(AD); -- Summit of hill, c. 2 km E of Callington, 47 km SE of Adelaide, 35°07'S, 139°02'E, on soil, 11.viii.1981, [gyr.], leg. M. & H. Mayrhofer 2697 (GZU); -- 28 mi (45 km) E of Murray Bridge on road to Karoonda, [35°08'S, 139°45'E], 11.v.1966, [no subst.], leg. R.W.Rogers 396 (AD); -- 50 km E of Adelaide near Murray Bridge Road, [35°08'S, 139°08'E], on soil in grassland, 11.ix.1969, [gyr.], leg. R.W.Rogers 357 (AD 97650001); -- Southern Lofty Range, between Finnis and Strathalbyn, 45 km SE of Adelaide, [35°20'S, 138°50'E], 23.iii.1968, [no subst.], leg. V.Cruickshank (AD); -- Southern Lofty, 2 mi W of Finnis, [35°23'S, 138°47'E], sandy soil amongst mallee, 6.xi.1968, [gyr.], leg. R.W.Rogers 1546 (AD); -- Kangaroo Island, Murrys Lagoon, 23 km SE of Parndana, 35°55'S, 137°25'E, on quartzite rocks bordering *Melaleuca* thicket, 20 m, 25.x.1985, [gyr., sax.], leg. J.A.Elix 19605 (ANUC); -- South-eastern Parra-Wirra National Park, [37°01'S, 140°41'E], hill top in *Eucalyptus* scrub, 17.i.1966, [gyr.], leg. R.W.Rogers 82 (AD).

Queensland: Davies Creek National Park, Davies Creek Falls, 17°00'S, 145°35'E, termite mounds in open woodland, c. 500 m, 4.iii.1986, [no subst.], leg. G. Rambold 4941, 4943 (M); -- [no subst.], 4944 (M); -- St Lucia, Cromwell College, 22°31'S, 153°01'E, soil by roadside, 6.vi.1983, [no subst.], leg. R.W.Rogers (BRIU); -- On the road to Tandora NE of Maryborough, 25°27'S, 152°48'E, c. 20 m, 22.viii.1986, [no subst.], leg. J.Hafellner 15589 (hb. Hafellner, GZU).

New South Wales: 30 mi (48 km) N of Bourke, [29°40'S, 145°53'E], 30.xi.1966, [no subst.], leg. R.W.Rogers 741 (AD); -- Northern side of Moornpa Road, 1 mi from Dorriggo Tyfingham Road, [30°17'S, 152°3(?)E], on soil, 30.x.1965, [no subst.], leg. R.Filson 7724 (MEL); -- Wollomombi Falls, 26 mi E of Armidale, [30°32'S, 152°02'E], on termite mound in moist sclerophyll forest, 24.x.1968, [no subst.], leg. W.A. Weber & D.McVean (COLO L-49864); -- 50 mi SE of Bourke, [30°45'S, 146°29'E], 30.xi.1966, [no subst.], leg. R.W.Rogers 752 (AD); -- 42.5 km NNW of Cobar, Bundella Station, Elura mining lease, near Joe's Tank, 31°08'S, 145°40'E, 250 m, 7.ix.1978, [no subst.], leg. M.D.Crisp 4133 (CBG); -- 90 mi (145 km) SE of Bourke, [31°10'S, 146°50'E], 30.xi.1966, [no subst.], leg. R.W.Rogers 759 (AD); -- Castlereagh River, 8 km W of Coonabarabran, 31°15'S, 149°11'E, 600 m, 26.viii.1979, [no subst.], leg. H.Streimann 9281 (CBG, H, M, NICH, US); -- 20 mi (32 km) W of Cobar, [31°30'S, 145°30'E], 1.xii.1966, [no subst.], leg. R.W.Rogers 778 (AD); -- 1 mi (1.6 km) W of Cobar, [31°31'S, 145°47'E], 1.xii.1966, [no subst.], leg. R.W.Rogers 775 (AD); -- 20 mi E of Cobar, [31°32'S, 146°11'E], 30.xi.1966, [no subst.], leg. R.W.Rogers 772 (AD); -- 40 mi (65 km) W of Cobar, [31°34'S, 145°08'E], 1.xii.1966, [no subst.], leg. R.W.Rogers 783, 784 (AD); -- Western Plains, Yathong Nature Reserve, 4.7 km from Rockholes Road S along W fence of SE corner, 32°46'S, 145°35'E, c. 170 m, 18.x.1979, [gyr.], leg. E.M.Canning 4908 (CBG, NICH); -- Mt Hope, [32°51'S, 145°53'E], v.1906, [gyr.], leg. J.L. Boorman (NSW 169070); -- Yara Station near Mt Hope, [32°51'S, 145°53'E], ix.1965, [no subst.], leg. D.McVean 6518 (CBG, COLO); -- On NE slope of Mt Canobolas, near Orange, 33°17'S, 149°06'E, on rock, 1320 m, 1.iv.1978, [gyr., sax.], leg. J.A.Elix 4630 (ANUC); -- Lithgow, [33°29'S, 150°10'E], ix.1897, [gyr., sax.], leg. F.R.M.Wilson (NSW 155816); -- Warranderry Range, Warranderry State Forest, 23 km N of Grenfell, 33°41'S, 148°12'E, in *Callitris* woodland 380 m, 17.x.1984, [sax, gyr.], leg. J.A.Elix 17707 (ANUC); -- Blue Mountains National Park, near Warragamba Dam S of Penrith, [33°45'S, 150°40'E], on termite mound, 2.x.1981, [no subst.], leg. H.Mayrhofer 3427 (GZU); -- Weddin State Forest, 25 km WSW of Grenfell, [33°50'S, 147°59'E], on soil in *Callitris* forest, 14.vii.1978, [gyr.], leg. J.A.Elix 4762 (MEL); -- Weddin Range, 15 km W of Grenfell, 33°54'S, 148°01'E, 450 m, 17.x.1984, [no subst.], leg. J.A.Elix 17695 (ANUC); -- Weddin State Forest, 25 km WSW of Grenfell, [33°55'S, 147°59'E], on soil in *Callitris* forest, 14.vii.1978, [no subst.], leg. J.A.Elix 4744 (MEL); -- Wyalong, [33°56'S, 147°15'E], ix.1906, [gyr.], leg. J.L.Boorman (NSW 169071); -- Belanglo State Forest, 37 km N of Marulan, [34°23'S, 150°00'E], 30.v.1975, [no subst.], leg. R.Filson 15358 (MEL); -- 5 km S of Balranald, along road to

Kyalite, [34°42'S, 143°33'E], 27.viii.1978, [no subst.], leg. J.A.Elix 4896 (ANUC); -- C. 91 km N of Jerilderie, 35°00'S, 146°00'E, on soil exposed, 23.vii.1974, [gyr.], leg. J.M.Gilbert (HO 63766); -- Great Dividing Range, 12.6 km E of Bungendore, [35°15'S, 149°35'E], on soil in dry sclerophyll forest, 23.iii.1977, [no subst.], leg. J.A.Elix 3019 (MEL); -- Kosciusko National Park, 12 km from Rules Point on Rules Point - Brindabella road, 35°37'S, 148°36'E, pebbles on bare soil in grassland, 1400 m, 21.i.1986, [gyr., sax.], leg. G.Rambold 3780 (Hertel, Lecideac Exs. no. 207, M); -- Tinderry Mtns, 9 km ESE of Michelago, 35°45'S, 149°15'E, 1250 m, 10.ix.1987, [gyr.], leg. H.T.Lumsch 5642 d (hb. Lumsch); -- Kosciusko National Park, Three Mile Creek, 5 km N of Klandra, 35°50'S, 148°49'E, beside Kiandra - Yarrangobilly road c. 1400 m, 20.i.1981, [gyr., sax.], leg. G.Rambold 3752 (M).

A.C.T.: Between Latham and Macgregor, 14 km NW of Canberra, 35°13'S, 149°01'E, grasslands on westerly slope, 560 m, 8.vi.1981, [sax, gyr.], leg. H.Streimann 15562 (CBG, M); -- Trail to other peak, Black Mountain Reserve, Canberra, [35°17'S, 149°06'E], on soil bank in dry sclerophyll forest, 640 m, 8.vii.1979, [no subst.], leg. J.A.Elix 6126 (ANUC); -- Western slopes of Black Mountain, Canberra, [35°17'S, 149°06'E], on soil under *Eucalyptus*, 2300 ft, 24.i.1975, [gyr.], leg. J.A.Elix 572 (ANUC).

Victoria: Sandhills to the N of Red Ochre Lake, Hattah Lakes National Park, [34°45'S, 142°15'E], 5.vi.1970, [gyr.], leg. G.W.Anderson (MEL 37747); -- Hattah Lakes, [34°45'S, 142°15'E], 14.vi.1965, [no subst.], leg. R.Filson 7328 (MEL); -- 30 km W of Ouyen along Highway 12, [35°09'S, 142°00'E], on soil in mallee scrub, 120 m, 28.viii.1977, [gyr.], leg. J.A.Elix 3684 (ANUC); -- Rock Ridge, 1 mi NW of Rock Holes, 29 mi N of Carina, 6 mi W of Murrayville, Ouyen Highway, [35°16'S, 141°05'E], 16.xi.1971, [gyr.], leg. R.Filson 14290 (MEL); -- Vicinity by tree E of Lake Jerriwirrup, Wyperfeld National Park, [35°35'S, 142°00'E], 27.viii.1978, [gyr.], leg. R.Filson 16007 (MEL); -- Junction of Meridian Track and Moonah Fire Track, Wyperfeld National Park, [35°35'S, 142°00'E], 30.viii.1978, [gyr.], leg. R.Filson 16063 (MEL); -- Western side of Wyperfeld National Park, on fire access track 20 mi W of Wonga Hut, [35°35'S, 142°00'E], 29.viii.1978, [no subst.], leg. R. Filson 16009 (MEL); -- Copi flats, south side of Wyperfeld National Park, 125 km N of Horsham, 35°36'S, 142°04'E, 18.viii.1981, [no subst.], leg. M.& H.Mayrhofer 2837 (GZU); -- [no subst.], leg. M.& H.Mayrhofer 2877 (GZU); -- Red Bluff, about 50 mi NW of Kaniva, [35°45'S, 141°(?)E], on open ground between bushes on the tops of the rises, 18.xi.1971, [no subst.], leg. R.Filson 14381 (MEL); -- Lochiel Salt Lake NW of Dimboola, 7.ix.1962, [gyr.], leg. A.C.Beaglehole 9430 (MEL); -- Dimboola, [36°27'S, 142°02'E], on earth, [no date], [no subst.], leg. F.M.Reader (MEL 6973); -- S of Kaniva, Little Desert, [36°30'S, 141°15'E], x.1949, [gyr.], leg. A.C.Beaglehole (MEL 1020556); -- Eastern Little Desert, [36°30'S, 141°45'E], x.1948, [gyr.], leg. A.C.Beaglehole 1178 (MEL); -- Rock outcrop in Little Desert, 3 mi W of Kaniva - Edenhope road, 17 km S of Kaniva, [36°33'S, 141°15'E], 18.xi.1971, [gyr.], leg. R.Filson 14384 (MEL); -- Near Rifle Range, Bendigo, [36°46'S, 144°17'E], 25.x.1947, [no subst.], leg. P.Bibby (MEL 6899); -- Gippsland, Manaak Creek, 11 km NE of Suggan Buggan, 36°54'S, 148°25'E, open *Callitris* forest with scattered *Leptospermum*, 200 m, 21.ix.1978, [gyr.], leg. D.Verdon 3624 (CBG); -- Along the western bank of the Snowy River, just S of the N.S.W. border, [36°54'S, 148°25'E], 200 m, 21.ix.1978, [no subst.], leg. J.A.Elix 5036 (ANUC); -- From Rubican at crest of Black Range, Taggerty, on loose fragments of Silurian sandstone, [37°19'S, 145°43'E], 9.v.1973, [gyr., sax.], leg. J.H.Willis (MEL 1018487); -- Melton, [37°41'S, 144°35'E], vii.1959, [gyr.], leg. S.L.Thrower M2 (COLO); -- Lara, 38°01'S, 144°25'E, on soil in the open, vi.1968, [no subst.], leg. R.C.Weeks (HO 48179); -- Road N from Moondarra c. 25 km N of Moe, 38°01'S, 146°27'E, 1976, [no subst.], leg. G.C.Bratt 76/510 (HO); -- Lara, 8 mi N of Geelong, [38°02'S, 144°25'E], 8.xii.1940, [gyr.], leg. J.H.Willis (MEL 7248); -- Kattyong, 31.viii.1951, [gyr.], leg. D.W.Goodall (MEL 1018459).

Lecidea sarcogynoides Koerb.

KOERBER, Syst. Lich. Germaniae: 252 (1855); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 685 - 686 no. 6705 (1925); 8: 357 (1932); HERTEL, Decheniana 127: 56, 59, 72 (1975); HERTEL, Beih. Nova Hedwigia 79: 422, 486 (1984); SANTESSON, Lich. Sweden Norway: 174 (1984); ROWE & EGEA, Lazaroa 8: 337 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 63 (1986); HERTEL, Mitt. Bot. Staatssamml. München 23: 329 (1987); NIMIS & POELT, Studia Geobotanica 7, suppl.1: 129 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 19, 106 (1988).

≡ *Lecidea calcarea* var. *sarcogynoides* (Koerb.) Boist., Nouv. Flore Lich. 2: 208 (1903).

Type: POLEN: Schlesien: [no locality, no date], leg. G.W.Koerber (L, holotype) - [n.v.].

= *Lecidea triangularis* H.Magn. **syn. nov.**

MAGNUSSON, Svensk Bot. Tidskr. 37: 284 - 285 (1943); HERTEL, Beih. Nova Hedwigia 79: 422, 486 (1984); GALLOWAY, Fl. New Zeal. Lich.: 237, 634 (1985).

Type: NEW ZEALAND: South Island: North Otago Botan. Prov., Cromwell, rocks at the railway station, 17.iii.1927, G.E.& G. Du Rietz 2178:9 (UPS!, holotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: more or less cryptothalline, rimose or verrucose to areolate, up to 70 mm diam.

AREOLES: irregularly angular to roundish, white, grey to pale brown, plane to irregularly convex, with rough to smooth or nitid surface, c. 0.3 - 0.7 mm, max. 0.9 - 1.4 mm diam. Cortex up to 35 µm thick; upper cell layer grey-brown or not pigmented; hyphae c. 4 - 5 µm diam.; epinecral layer rarely developed. Algal layer c. 55 - 70 µm thick; algal cells c. 10 - 13 µm, max. 13 - 18 µm diam. Medulla I-; hyphae 3 - 4 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: round to irregularly shaped, dispersed or crowded, 15 - 140/cm², more or less constricted at the base, c. 0.5 - 1.1 mm, max. 0.7 - 1.6 mm diam. Disc plane to convex, black, grey, matt to subnitid, occasionally pruinose. Margin at first distinct, later mostly vanishing, black, rarely grey, matt to subnitid.

EXCIPULUM: max. 50 - 90 µm, lateral of hymenium (35 -) 50 - 80 µm thick. Ectal zone black-brown; pigmented zone 10 - 20 µm thick; hyphae 3 - 5 µm diam., with lumina of 1.3 - 3 µm. Inner zone red to pale brown or colourless; hyphae c. 4 - 5 (- 6) µm diam., with lumina of (1.5 -) 2 - 3 µm. Medullary zone not developed.

HYPOTHECIUM: dark brown, (50 -) 80 - 180 (- 300) µm tall; hyphae 3 - 4 µm diam.; subhymenial layer reddish to colourless, 15 - 30 µm tall.

HYMENIUM: (30 -) 35 - 45 (- 60) µm tall, red to colourless, I+ bluish-brown, I_{conc.}+ red. Epihymenium black, green-black, 7 - 15 µm

tall. Paraphyses more or less branched, occasionally anastomosing, 1.8 - 2.2 μm , apices 2.5 - 4 μm thick. Asci c. 28 - 40 x 7 - 11 μm ; tholus max. 5 - 11 μm , min. 3 - 4 μm thick; outer amyloid wall layer 0.2 - 0.7 (- 1) μm thick, I+ bluish-brown, I_{conc.}+ brown to red; non-amyloid wall layer c. 0.2 μm thick; amyloid cap c. 0.1 - 0.5 μm thick. Spores oblong to ellipsoid-oblong, 7 - 9.5 - 11 - 15 x 2.8 - 4 μm .

Pycnidia: immersed. Conidia 6 - 7 x 1 μm .

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K- (K+ reddish), P-, C-.

One chemotype observed, containing no lichen substances; rarely with traces of confluent acid (36 specimens examined).

DISTRIBUTION:

Xeric. *L. sarcogynoides* is a widely distributed species common in warm to arid regions of the Southern and the Northern Hemisphere. It has been collected in South Africa (Cape Prov., Natal), Australia

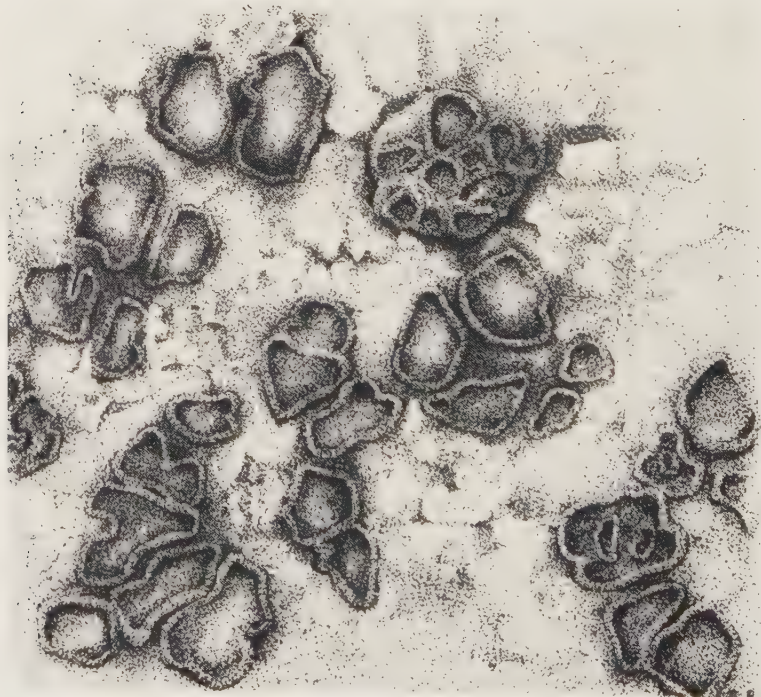


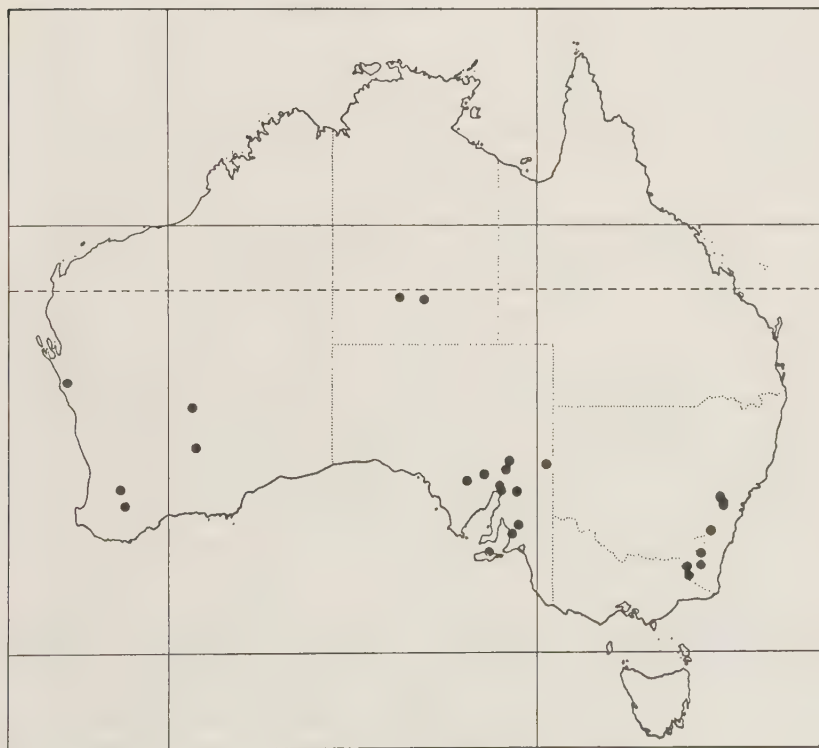
Fig. 19. *Lecidea sarcogynoides*. (GR 3655, M) Scale = 1 mm.

(incl. Tas.) and New Zealand and has also been reported from South America (HERTEL 1984: 422). Within continental Australia it is restricted to W.A., S.A., N.T., and N.S.W. (map 32), growing on siliceous rock at lower altitudes.

NOTES:

L. sarcogynoides is characterized by a non-amyloid medulla, narrow spores and the absence of lichen substances. Typically it has a red pigmented inner zone of excipulum (the tinge of which intensifies in K) and a reddish hymenium. Specimens with a colourless hymenium are not separable from the 'typical' samples by additional correlated characters.

Aside from *L. sarcogynoides*, there are two other species occurring in Australia, *L. capensis* and *L. tragorum*, which show a similar combination of anatomical characters. However they have an areolate, nitid brownish thallus. *L. capensis* differs from *L. sarcogynoides* mainly in thallus morphology and chemistry. It produces 2'-O-methylperlatolic



Map 32. Distribution of *Lecidea sarcogynoides* in continental Australia

acid as the major constituent and mostly lacks the typical reddish pigmentation of hymenium and excipulum, which is found in *L. sarcogynoides*.

L. tragorum differs by thallus morphology and chemistry also. Two chemical strains were observed, one producing confluent acid, accompanied by 2'-O-methylmicrophyllinic acid, the other containing no lichen substances. *L. tragorum* scarcely shows a reddish pigmentation of the hymenium and excipulum. The lichen acid deficient strain differs from *L. sarcogynoides* especially by the well developed, nitid brown thallus.

SPECIMENS EXAMINED:

Western Australia: Kalbarri National Park, "Z"-Bend, Murchinson River Canyon, [27°40'S, 114°25'E], 29.viii.1987, leg. H.T.Lumsch 5532 e (hb. Lumsch); -- Hill, c. 5 km E of Leonora, 28°53'S, 121°20'E, v.1985, leg. D.E.Vaughan (MEL 1048727); -- Near Kalgoorlie, [30°45'S, 121°28'E], vii.1982, leg. M.F.Day JAE 10468 (ANUC); -- Dryandra Forestry Reserve, 14.5 km NE of Narrogin, [32°52'S, 117°19'E], along Kawana road near the Lol Gray Picnic Area, 3.x.1981, leg. N.Sammy 840814 (PERTH); -- 8 km SE of Woodanilling, 33°36'S, 117°30'E, sandstone boulders in paddock beside Great Southern Highway, 300 m, 3.iv.1986, leg. G.Rambold 5417, 5423, 5427, 5432 (M).

Northern Territory: Mt Sonder, Macdonnell Ranges, 80 mi W of Alice Springs, [23°35'S, 132°34'E], 13.v.1970, leg. J.R. Brownlie (MEL 37825, 37826); -- Alice Springs, Alice Springs Telegraph Station Historical Reserve, 23°40'S, 133°53'E, conglomerate sandstone boulders (S aspect) near carpark, c. 600 m, 15.iii.1986, leg. G.Rambold 5027, 5030 (M).

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G.Rambold 5502, 5504, 5505, 5507, 5519 (M); -- Mt John, Wilpena Pound, 31°37'S, 140°34'E, 26.viii.1970, leg. G.C.Bratt 70/1026 (HO); -- Flinders Ranges, Nooltana Creek, 12 km N of Hawker, 31°49'S, 138°23'E, 550 m, 29.x.1984, leg. J.A.Elix 17923, 17937 (ANUC); -- Yundnapinna Station, [32°06'S, 137°08'E], 26.vi.1965, leg. R.W.Rogers 26 (BRIU); -- Southern Lake Gairdner Basin, Iron Knob Yardea road, c. 25 km E from Mt Ive and c. 20 km W of Nonning, [32°25'S, 136°17'E], 27.vii.1968, leg. J.Z.Weber 1214 (AD); -- Hancock Lookout, South Flinders Ranges, 8 km SW of Wilmington, 32°42'S, 138°02'E, very rocky grazing land with scattered *Casuarina*, 540 m, 8.v.1985, leg. J.A.Curnow 176 (CBG); -- Side track, 100 yards of Main Germein, Gorge road, 10 miles E of Port Germein, [32°58'S, 138°09'E], 16.xi.1975, leg. R.Filson 15543 (MEL); -- 16 km N of Terowie, c. 200 km N of Adelaide, hillside W of Highway, [33°01'S, 138°57'E], [no date], leg. R.D.Seppelt 2860 (MEL); -- Flinders Ranges, Telowie Gorge, [33°03'S, 138°08'E], 14.i.1967, leg. R.Filson 9495 (MEL); -- Tanunda Creek, 4 mi SW of Angaston, [34°33'S, 139°00'E], decaying granite among grass, 31.xii.1967, leg. R.W. Rogers 1358 (BRIU, COLO L-51897); Hillside in Torrens Gorge near Castanbul, 16 km NE of Adelaide, 34°52'S, 138°46'E, 160 - 180 m, 12.viii.1981, leg. M.& H.Mayrhofer 3025 (GZU); -- Kangaroo Island, just S of Wisanger Hills H.S., 7 km WSW of Emu Bay, [35°37'S, 137°27'E], 80 m, 27.x.1985, leg. J.A.Elix 19647 (ANUC).

New South Wales: Great Dividing Range, S of Hartley, SW Katoomba, 33°15'S, 150°10'E, c. 850 m, 30.ix.1981, leg. M.& H.Mayrhofer 3402 (GZU); -- Blue Mountains, Hat Hill, 4 km ENE of Blackheath, 33°36'S, 150°19'E, rocky outcrops, 1033 m, 1.ii.1986, leg. G.Rambold 4158 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing outcrops of sandstone (partially shaded), SE facing sandstone rock walls beside Dardanelles Pass Walking Track, 760 - 900 m, 1.ii.1986, leg. G.Rambold 4136 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing sandstone cliffs between "The Three Sisters" and "Echo Point", 920 m, 1.ii.1986, leg. G.Rambold 4143 (M); -- Goulburn, [34°45'S, 149°43'E],

18.iv.1908, leg. E.Cheel (NSW 155755); -- Tinderry Mountains, 10 km ESE of Michelago, [35°45'S, 148°18'E], 1250 m, 15.xi.1981, leg. H.Streimann 15829 (CBG, H); -- Tinderry Mountain, 10 km ESE of Michelago, 35°45'S, 148°18'E, dry sclerophyll forest on gentle westerly slope, on rocks in shaded road cutting, 1250 m, 15.xi.1981, leg. H.Streimann 15927 k-o (M); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3907, 3932 (M); -- 17 km ESE of Michelago, Michelago - Jingera Track, 35°45'S, 149°21'E, dry sclerophyll forest on gentle slope, 970 m, 26.i.1986, leg. G.Rambold 3943, 3945, 3947, 3948 (M); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, leg. G.Rambold 3649, 3652, 3655, 3656, 3668 (M); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G.Rambold 3696 (M); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, 1620 - 1680 m, 3.iii.1985, leg. H.Hertel 31831, 31835, 31844, 31819 (M); -- 28 km SSW of Jindabyne, near Ingebyra, 36°39'S, 148°30'E, big and small granitic boulders in pasture land beside Buchan - Jindabyne road, c. 950 m, 13.i.1986, leg. G.Rambold 3364, 3365, 3370, 3373, 3374 (M).

Lecidea terrena Nyl. in Crombie

Nyl. in Crombie, J. Linn. Soc., Bot. 15: 177 (1876); HUE, Nouv. Arch. Mus. Paris, ser. 3, 3: 131 (1891); STIZENBERGER, Ber. Tätigk. (Jahrb.) St. Gallischen. Naturwiss. Ges. 1889-1890: 156 no. 1083 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 708 no. 6810 (1925); DOIDGE, Bothalia 5: 278 (1950).

Type: REP. SOUTH AFRICA: "Table Mount, Cape of Good Hope, September 1874", leg. A.E. Eaton (BM!, holotype, BM!, isotype: "*Lecidea meiospora* f. *terrena* Nyl.") - [containing confluent acid, 2'-O-methylperlatolic acid and 2'-O-methylmicrophyllinic acid].

= *Lecidea squamifera* Stiz. **syn. nov.**

STIZENBERGER, Ber. Tätigk. (Jahrb.) St. Gallischen Naturwiss. Ges. 1889-1890: 160 no. 1101 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 696 no. 6739 (1925); DOIDGE, Bothalia 5: 276 (1950).

Type: REP. SOUTH AFRICA: Cape Province: "Prope Kapstadt, Mte. Leonis", [no date], leg. P.MacOwan (ZT!, holotype, ZT! two isotypes) - [containing confluent acid, 2'-O-methylperlatolic acid and 2'-O-methylmicrophyllinic acid].

= *Lecidea nodulosa* Stirt. in Bailey **syn. nov.**

BAILEY, Queensl. Agric. J. 5: 488 (1899); FILSON, Austr. Fl. Fauna Ser. 4: 125 (1986).

= *Lecania nodulosa* (Stirt.) Zahlbr., Catal. Lich. Univ. 5: 736 no. 10908 (1928); WEBER & WETMORE, Beih. Nova Hedwigia 41: 46 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 40 (1983); Checklist Austr. Lich. 2. ed.: 52 (1986); Checklist Austr. Lich. 3. ed.: 96 (1988).

[Because of the misleading original description ("Sp. 8, oblong-ellips. incol. 4- loc. vel irreg. 3-6 loc....") Zahlbruckner regarded the species as belonging to *Lecania*, however, incorrectly gave "*Lecanora nodulosa* Stirt." as basionym.]

Type: AUSTRALIA: "Warwick (Queensland), [no date], J.M. Bailey" (according to the description, the collector should be C.J.Gwyther) (BM!, holotype (?), GLAM!, isotype - selected as lectotype by ROGERS 1982b) - [containing confluent acid].

- non *Lecidella nodulosa* Koerb., 1861, falsely named in ZAHLBRUCKNER (1925) "*Lecidea nodulosa* Koerb."

= *Lecidea brachysporoides* Räs.

RÄSÄNEN, Ann. Bot. Soc. Zool.-Bot. Fenn. "Vanamo" 20: 25 (1944). FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); HERTEL, Beih. Nova Hedwigia 79: 418 (1984) pro syn.; FILSON, Checklist Austr. Lich. 2. ed.: 57 (1986); Austr. Fl. Fauna Ser. 4: 112 (1986); Checklist Austr. Lich. 3. ed.: 101 (1988).

Type: AUSTRALIA: New South Wales: "Wagga-Wagga, ad rupem graniticam", 23.v.1892, F.R.M.Wilson (H!, holotype) - [not analyzed chemically].

= *Lecidea leptocarpa* Nyl. var. *terrigena* Räs. **syn. nov.**

RÄSÄNEN, Arch. Soc. Zool. Bot. Fenn. Vanamo 3: 183 (1949); LAMB, Index Nom. Lich.: 362 (1963); WEBER & WETMORE, Beih. Nova Hedwigia 41: 53 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 122 (1986); Checklist Austr. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: New South Wales: Eastern Cruk (= Creek ?), 1892, leg. F.R.M.Wilson (H!, holotype) - [containing confluent acid].

DESCRIPTION:

Thallus: verrucose to areolate or cryptothalline, up to 60 mm diam., up to c. 0.4 mm thick.

AREOLES: irregularly angular, white to grey, plane to subconvex, with rough surface, c. 0.4 - 0.7 mm, max. 0.6 - 1.2 mm diam. Cortex c. 20 µm thick; upper cell layer not pigmented; epinecral layer not developed. Algal layer c. 40 µm thick. Medulla I-.

HYPOTHALLUS: obvious between the areoles and/or at the thallus margin, mostly not developed.

Apothecia: roundish to sublobate, dispersed, 60 - 120/cm², sessile, mostly not constricted at the base, c. 0.4 - 0.9 mm, max. 0.5 - 1.2 mm diam. Disc plane to subconvex, grey to black, often pruinose. Margin at first distinct, later mostly persistent, black, matt.

EXCIPULUM: max. 60 - 140 µm, lateral of hymenium 50 - 100 µm thick. Ectal zone brownish-black; pigmented zone 12 - 20 µm thick; hyphae c. 3.5 - 4 µm diam., with lumina of c. 1.2 - 2 µm. Inner zone

colourless to pale brown; hyphae 3 - 6 μm diam., with lumina of 1 - 2.5 (- 3) μm . Medullary zone more or less developed.

HYPOTHECIUM: dark brown, 110 - 200 μm tall; hyphae 2.5 - 3 μm diam.; subhymenial layer colourless, 10 - 25 μm thick.

HYMENIUM: 60 - 90 μm tall, colourless to pale green, I $\pm$ blue, I_{conc.} bluish-brown to red. Epihymenium dark green-brown, 5 - 15 μm tall. Paraphyses rarely branched and anastomosing, c. 1.5 - 2 μm , apices 2.5 - 3 (- 4) μm thick. Asci c. 45 - 75 x 10 - 15 μm ; tholus max. 10 - 15 μm , min. 4 - 6 μm thick; outer amyloid wall layer c. 1 μm thick, I $\pm$ brown, I_{conc.} red-brown; non-amyloid wall layer c. 0.2 μm thick; amyloid cap more or less obvious. Spores ellipsoid, 7 - 7.8 - 16.3 - 20 x 4 - 4.3 - 7.2 - 8 μm .

Pycnidia: immersed. Conidia 7 - 6.9 - 8.3 - 10 x 1 μm .

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

Two chemotypes observed:

- a) containing confluent acid (major), 2'-O-methylperlatolic acid (minor, traces or not), 2'-O-methylmicrophyllinic acid (minor, traces or not) (95 examined specimens: 75 saxicolous, 20 terricolous);
- b) containing no detectable lichen substances (19 specimens examined).

DISTRIBUTION:

Southern xeric. *L. terrena* is only known from the Southern Hemisphere. The species occurs in South Africa (Transvaal, Cape Prov.) and in continental Australia (W.A., S.A., Qld, N.S.W., A.C.T., Vic.) (map 33), growing predominantly on sandstone, less frequently on soil at lower altitudes (from sea level to c. 1700 m) under temperate to arid climatic conditions. As yet there are no reports for Tasmania or New Zealand.

NOTES:

L. terrena is characterized by a whitish to greyish, occasionally indistinct thallus, a non-amyloid medulla, quite broad spores, a colourless to greenish hymenium and the presence of confluent acid or the lack of any lichen substances. The species usually grows on rock and less frequently on soil or compressed sand. It closely resembles the usually terricolous *L. ochroleuca*.

Very large spores can be found in south-eastern Australian populations of this species. Specimens with much smaller spores dominate in Queensland. One collection from the Northern Territory, however, also shows spores as large as in southern populations (fig. 20). In this delimitation, *L. terrena* perhaps represents a species complex. No correlating characters could be found to divide it satisfactorily into more well delimited entities. The differences to *L. ochroleuca* are discussed under the latter.

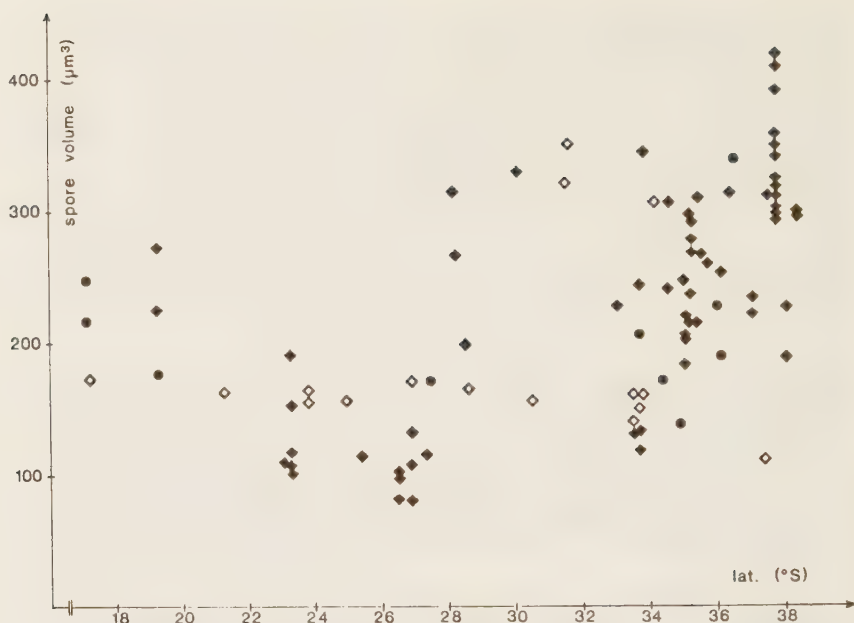


Fig. 20. Spore volume - geographical latitude diagram of *Lecidea terrena* in continental Australia: saxicolous, containing confluent acid [◆]; saxicolous, containing no lichen substances [◇], terricolous, containing confluent acid [●].

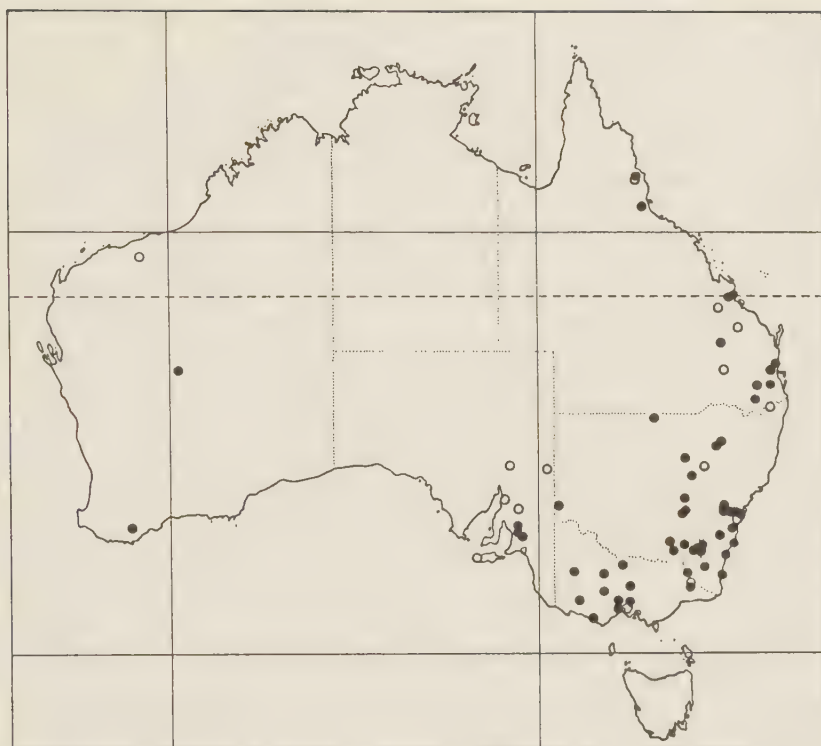
The specimens from south-eastern Australia are chemically and anatomically rather identical to the South African type material and the few other specimens collected there. However, the conspecificity of the Australian and the South African taxa remains uncertain, and more and better developed South African material needs to be examined.

EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no. 209 ("*Lecidea nodulosa*") (M)

SPECIMENS EXAMINED:

Western Australia: Djarda Gorge, between Millstream and Gregory Gorge on the Fortesque River, Pilbara, [21°15'S, 118°19'E], 7.xi.1976, [no subst.], leg. N. Sammy 810332 (PERTH); -- 46 km S of Wiluna, 26°56'S, 120°25'E, 21.viii.1973, [confl., terr.], leg. R.W.Rogers 1213 (BRIU); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, [confl.], leg. G.Rambold 5366 (M).



Map 33. Distribution of *Lecidea terrena* in continental Australia
(containing confluent acid [●], containing no lichen substances [○])

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1000 m, 8.iv.1986, [no subst.], leg. G.Rambold 5490 (M); -- Mt John, Wilpena Pound, 31°37'S, 140°34'E, 26.viii.1970, [no subst.], leg. G.C.Bratt & J.A.Cashin (HO 63667); -- 14.5 km N of Crystal Brook on the Beetaloo Reservoir Road, [33°16'S, 138°15'E], 21.x.1970, [no subst.], leg. R.Filson 11719 (MEL); -- Burra Copper Mine, 33°41'S, 138°56'E, 2.x.1967, [no subst.], leg. G.C.Bratt 67/161 (HO 63688); -- Southern Lofty Region, c. 8 km N of Greenock, [34°23'S, 138°55'E], 29.x.1968, [confl., terr.], leg. R.W.Rogers 1491 (AD); -- Humbug Scrub, 25 mi NE of Adelaide, [34°40'S, 138°55'E], 9.iv.1967, [confl.], leg. J.Curtis (MEL 515854); -- C. 3 km NE of Native Valley, (c. 50 km E of Adelaide), [34°53'S, 139°09'E], 4.xi.1968, [confl., terr.], leg. R.W.Rogers 1523 (AD); -- 2 mi NE of Native Valley, 30 mi E of Adelaide, 34°53'S, 139°09'E, 5.xi.1968, [confl., terr.], leg. R.W.Rogers 1523 (COLO); -- Kangaroo Island, Scotts Cove Lookout, 3 km E of Cape Borda, 35°46'S, 136°37'E, 120 m, 29.x.1985, [no subst.], leg. J.A.Elix 19720 (ANUC).

Queensland: Davies Creek National Park, Davies Creek Falls, 17°00'S, 145°35'E, termite mounds in open woodland, c. 500 m, 4.iii.1986, [confl., terr.], leg. G.Rambold 4945, 4946 (M); -- Tinnaroo Falls Dam Road, 12 km NE of Atherton, 17°11'S, 145°33'E, 670 m, 27.vi.1984, [no

subst.], leg. J.A.Elix 16589 (ANUC); -- Blue Water Creek, Old Mill Road, 39 km WSW of Ingham, 18°45'S, 145°48'E, 600 m, 19.vi.1984, [confl.], leg. H.Streimann 28470 (CBG, M); -- Lannercoast State Forest, Blue Water Creek, Old Mill Road, 39 km WSW of Ingham, 18°45'S, 145°48'E, 600 m, 19.vi.1984, [confl.], leg. J.A.Elix 15577 (ANUC); -- Blue Water Creek, Old Mill Road, 39 km WSW of Ingham, 18°45'S, 145°48'E, 600 m, 19.vi.1984, [confl., terr.], leg. H.Streimann 28470 (CBG, M); -- Rosslyn Bay, Double Head, 35 km NE of Rockhampton, 23°10'S, 150°48'E, on sheltered rock, near soil, c. 50 m, 13.ii.1986, [confl.], leg. G. Rambold 4466 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, [confl.], leg. G.Rambold 4432, 4435, 4437, 4439, 4441 (M); -- Blackdown Tableland National Park, Stony Creek Lookout, 23°47'S, 149°00'E, outcrops of sandstone, c. 720 m, 15.ii.1986, [no subst.], leg. G.Rambold 4526 (M); -- [no subst.], 4528 (M); -- Hurdle Gully, 8 km WSW of Monto, 24°54'S, 151°04'E, 300 m, 16.i.1980, [no subst.], leg. H.Streimann 9852 (CBG, H, M, US); -- Nathan Gorge, Cabbage Tree crossing, 25°27'S, 150°08'E, 200 m, 31.viii.1985, [confl.], leg. R.W.Rogers 7822 (BRIU); -- Mt Coolum, c. 90 km N of Brisbane, 26°34'S, 153°05'E, basaltic outcrops near summit in low heathland, c. 180 m, 11.ii.1986, [confl.], leg. G.Rambold 4412, 4413, 4416 (M); -- About 17 km E of Condamine, N of the road to Chinchilla, 26°53'S, 150°18'E, c. 400 m, 2.ix.1986, [no subst.], leg. J.Hafellner 15500 (hb. Hafellner); -- Glasshouse Mountains, N-facing hills SSW of Tibrogargal Mtn, 26°57'S, 152°56'E, 100 - 150 m, 19.viii.1986, [confl.], leg. J.Hafellner 15555, 15565, 15568 (hb. Hafellner); -- Bellbird Grove State Park E of Nebo Road, NW of Brisbane, 27°25'S, 152°53'E, 400 m, 1.viii.1986, [confl.], leg. J.Hafellner 15872 (GZU, hb. Hafellner); -- Helidon, [27°33'S, 152°08'E], [no date], [confl., terr.], leg. F.M.Bailey (BRI 354963); -- Mt Cordeaux, 28°04'S, 152°24'E, 800 m, 17.ix.1986, [confl.], leg. R.W.Rogers 8505 (BRIU); -- Warwick, [28°13'S, 152°02'E], 17.i.1899, [confl.], leg. F.M.Bailey (type of *Lecidea nodulosa* Stirt., BM, GLAM); -- Vambi Place, Glennie Heights, Warwick, [28°13'S, 152°02'E], 6.ix.1970, [confl.], leg. C.Pope (MEL 1045498).

New South Wales: Richmond Range State Forest, Toonumbar Dam, 28°37'S, 152°48'E, sandstone rock on clay road cutting, 8.ii.1986, [no subst.], leg. G. Rambold 4371 (M); -- 4376 (M, NSW); -- Waratah, [29°08'S, 146°28'E(?)], ix.1903, [confl., terr.], leg. J.Gregson (NSW 155796); -- Mt Kaputar National Park, Corrumbril Borawah, 30°17'S, 150°08'E, 1400 m, 7.iii.1987, [confl.], leg. P.Merrotsey 415 (BRIU); -- 20 km S of Narrabri, [30°29'S, 149°55'E], iii.1986, [confl.], leg. P.Merrotsey 354 (BRIU); -- Kuringal Chase, 31°07'S, 148°11'E, iv.1975, [confl.], leg. M.H.Bratt (HO 63660); -- Kuringal Chase, (southern end), 31°07'S, 148°11'E, iv.1975, [no subst.], leg. M.H.Bratt (HO 63660); -- Greenbah Creek, 29 km S of Coonabarabran, 31°30'S, 149°15'E, 450 m, 6.ix.1979, [no subst.], leg. H.Streimann 9473 (CBG); -- 29 km N of Dubbo along Hwy-39, [32°00'S, 148°37'E], 3.ix.1976, [confl., terr.], leg. J.A.Elix 2688 (ANUC); -- Parkes, [33°08'S, 148°11'E], ix.1981, [confl.], leg. M. & H. Mayrhofer 3255 (GZU); -- Du Fours Lookout, 1.5 km W of Mount Wilson, 33°30'S, 150°22'E, westerly exposed sandstone outcrops, 960 m, 2.ii.1986, [confl.], leg. G.Rambold 4170, 4184 (M); -- [no subst.], leg. G.Rambold 4181, 4182, 4183 (M); -- Belmore, [33°33'S, 141°13'E], 10.vii.1909, [confl., terr.], leg. A.A.Hamilton (NSW 180036); -- Blue Mountains, Pulpit Rock, 3 km ENE of Blackheath, 33°37'S, 150°20'E, horizontal surface of sandstone rock, 800 m, 1.ii.1986, [no subst.], leg. G.Rambold 4151 (M); -- [confl.], leg. G.Rambold 4152 (M); -- Warranderry Range, Warranderry State Forest, 23 km N of Grenfell, 33°41'S, 148°12'E, 380 m, 12.x.1984, [confl., terr.], leg. H.Streimann 31518 (CBG, H, M, US); -- [no subst.], leg. H.Streimann 31514 (CBG, M, US); -- Warranderry Range, Warranderry State Forest, 23 km N of Grenfell, 33°41'S, 148°12'E, 380 m, 17.x.1984, [confl., terr.], leg. J.A.Elix 17717 (ANUC); -- 24 km N of Grenfell along Forbes road, [33°43'S, 148°05'E], 15.vii.1978, [confl., terr.], leg. J.A.Elix 4818 (ANUC); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S

facing outcrops of sandstone (partially shaded), 905 m, 1.ii.1986, [confil.], leg. G.Rambold 4124 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, SE facing sandstone rock walls beside Dardanelles Pass Walking Track, 760 - 900 m, 1.ii.1986, [no subst.], leg. G.Rambold 4130, 4132 (M); -- [confil.], 4134, 4148 (M); -- Blue Mountains National Park, near Glenbrook, c. 60 km W of Sydney, [33°46'S, 150°37'E], ix.1981, [confil.], leg. M. & H. Mayrhofer 3274 (GZU); -- Parramatta, [33°47'S, 150°55'E], [no date], [confil., terr.], leg. (?) Woods (MEL 6896); -- Sydney Botanic Gardens, stone work of the statue "The Bather", [33°53'S, 151°13'E], 19.v.1908, [confil.], leg. E.Cheel (NSW 155797); -- Weddin Range, 15 km W of Grenfell, 33°54'S, 148°01'E, 430 m, 17.x.1984, [confil.], leg. J.A.Elix 17689 (ANUC); -- Between Heathcote and Waterfall, S of Sydney, [34°08'S, 150°58'E], 600 ft, 23.ix.1967, [no subst.], leg. W.A.Weber (COLO L-47273); -- 4 km E of Robertson, [34°35'S, 150°40'E], 730 m, 17.ix.1980, [confil.], leg. J.A.Elix 8922 (ANUC); -- Bungonia Lookdown, rim of Shoalhaven River, 7 mi of Bungonia [34°51'S, 150°03'E], 10.iv.1968, [confil., terr.], leg. W.A. Weber & D.McVean (COLO L-48900); -- Wagga Wagga, [35°07'S, 147°22'E], 23.v.1892, [confil.], leg. F.R.M.Wilson (type of *Lecidea brachysporoides* Räs., H); -- Granite Hill, 2 mi N of Adelong, [35°17'S, 148°04'E], 12.v.1968, [confil.], leg. R.Filson 10890 (MEL); -- Noonbah Property, Hume Hwy to Wagga Wagga road, 2 mi W of Hume Hwy, 20 km N of Holbrook, 35°37'S, 147°30'E, 31.v.1975, [confil.], leg. R.Filson 15373 (MEL); -- South Coast, Melua Bay, Little Bay Beach, 35°47'S, 150°14'E, 0 m, 10.iv.1975, [confil.], leg. D.Verdon 1088 (CBG); -- Cooma, Nanny Goat Hill Lookout, 36°14'S, 149°08'E, W exposed outcrops, 850 m, 18.i.1986, [confil.], leg. G.Rambold 3661 (M); -- Baragoot Point, 2.5 km S of Bermagui, [36°25'S, 150°04'E], 0 m, 4.iii.1978, [confil.], leg. J.A.Elix 4583c (M).

A.C.T.: Jervis Bay Territory, 4 km E of Jervis Bay, 35°08'S, 150°45'E, coastal rocks "Hole in the Wall", on horizontal surface, 5 m, 23.i.1986, [confil.], leg. G.Rambold 3828, 3833 (M), 3829, 3831 (M, CBG); -- Black Mountain, near Aranda, 5 km NW of Canberra, 35°15'S, 149°06'E, 640 m, 9.xi.1980, [confil.], leg. H.Streimann 10640 (CBG, M); -- Mt Ainslie, 5 km NE of Canberra, 35°15'S, 149°09'E, 800 m, 26.vii.1981, [confil.], leg. H.Streimann 15566 (CBG, H, M); -- Black Mountain, 5 km NW of Canberra, 35°16'S, 149°06'E, 780 m, 15.vi.1980, [confil.], leg. H.Streimann 10338 (CBG, H); -- Canberra Australian National Botanic Gardens, 35°17'S, 149°06'E, side of gully, on pebbles, 600 m, 29.i.1986, [confil.], leg. G.Rambold 4080, 4081 (M); -- Capital Hill, Canberra, [35°17'S, 149°13'E], 13.iii.1979, [confil.], leg. H.Streimann 7596 (CBG, H, M, US); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, 1420 m, 18.xii.1985, [confil.], leg. J.A.Elix 19764 (ANUC); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, rhyolite rocks, 1420 m, 27.i.1986, [confil.], leg. G.Rambold 4063 (M); -- Gudgenby River Gorge, 4.5 km S of Tharwa, [35°34'S, 149°05'E], 710 m, 26.vi.1979, [confil.], leg. J.A.Elix 6073 (ANUC).

Victoria: Echuca, [36°08'S, 144°45'E], ix.1952, [confil., terr.], leg. E.Dakin (MEL 7252); -- near Dimboola, [36°27'S, 142°02'E], [no date], [confil., terr.], leg. F.M.Reader (MEL 6949); -- 4 mi N of Rheola by an old mine shaft on the northern side of the Melville Caves Reserve, [36°35'S, 143°42'E], 1.xi.1964, [confil.], leg. R.Filson 6630 (MEL); -- Along the western bank of the Snowy River, just S of the N.S.W. border, [36°54'S, 148°25'E], 200 m, 21.ix.1978, [no subst.], leg. J.A.Elix 5045 (ANUC); -- Mac Killop Bridge, 14 km E of Wulgulmerang, 37°05'S, 148°25'E, 200 m, 12.i.1986, [confil.], leg. G.Rambold 3346 (M); -- Tallarook, 37°06'S, 145°06'E, 29.vii.1978, [confil.], leg. J.A.Elix 4852, 4892 (MEL 1024399); -- Mt Beachworth, 11 mi NW of Creswick, [37°19'S, 143°43'E], 16.xi.1963, [confil., terr.], leg. R.Filson 5671 (MEL); -- 8 km W of Melton, 1 km N of Anthony's cutting on the Djerriwarrah creek, 37°39'S, 144°31'E, 100 m, 10.x.1981, [confil.], leg. V.Wirth 10971, 10972, 11290 (STU); -- Dunkeld, [37°39'S, 142°21'E], 1896, [confil.], leg. F.R.M.Wilson (NSW 155884, 155892); -- Kew, Yarra Bend, [37°44'S, 145°09'E], 6.viii.1886, [confil.], leg. F.R.M.Wilson (NSW 155908); -- Kew,

banks of Yarra, [37°44'S, 145°09'E], 9.xii.1884, [confli.], leg. F.R.M.Wilson (NSW 155906); -- Kew, Yarra Boulevard, below Kew Mental Asylum, 37°48'S, 145°01'E, folded sedimentary soft rock on road side cuttings, 40 m, 16.iv.1986, [confli.], leg. G.Rambold 5589 (M); -- [confli.], 5592 (M); -- [confli.], 5595 (M); -- [confli.], 5596 (M); -- [confli.], 5597 (M); -- [confli.], 5602 (M); -- [confli.], leg. G.Rambold 5605 (Hertel, Lecideac. Exs. no. 209) (M); -- Kew Asylum grounds, 37°48'S, 145°01'E, 12.v.1900, [confli.], leg. R.A.Bastow (MEL 1018554); -- [confli.], leg. R.A.Bastow (MEL 1046966); -- Kew, 37°48'S, 145°01'E, vi.1885, [confli., terr.], leg. F.R.M.Wilson (NSW 155911); -- iv.1885, [confli., terr.], leg. F.R.M.Wilson (NSW 169073); -- viii.1887, [confli.], leg. F.R.M.Wilson (NSW 155768); -- Kew, asylum paddock, [37°48'S, 145°01'E], 30.iv.1885, [confli.], leg. F.R.M.Wilson (NSW 155902); -- Kew, [37°48'S, 145°09'E], 10.iii.1887, [confli.], leg. F.R.M.Wilson (NSW 155891); -- Studley Park, near Melbourne, [37°49'S, 144°58'E], 3.vi.1883, [confli.], leg. F.M.Reader (MEL 6975); -- Studley Park, [37°49'S, 144°58'E], 5.iii.1885, [confli.], leg. F.R.M.Wilson (NSW 155912); -- Studley Park, [37°49'S, 144°58'E], 1958, [no subst.], leg. S.L.Thrower 257 (BM); -- viii.1961, [confli.], leg. S.L.Thrower SP3 (COLO L-37004); -- 6.iv.1963, [confli.], leg. S.L.Thrower 780 (BM); -- Melbourne, Studley Park, [37°49'S, 144°58'E], [no date], [confli.], leg. S.L.Thrower 258 (BM); -- Point Wilson, 15 km NE of Geelong, [38°05'S, 144°30'E], iii.1980, [confli.], leg. A.Geddes (MEL 1029254); -- [confli.], leg. A.Geddes (MEL 1029150); -- [confli.], leg. A.Geddes (MEL 1029131); -- Camperdown - Port Campbell road, 38°25'S, 143°03'E, 30.vi.1968, [confli.], leg. G.C.Bratt 68/494, 68/495 (HO).

Lecidea tragorum Zahlbr.

Zahlbruckner, Ann. Mycol. 34: 168 (1936); DoIDGE, Bothalia 5: 278 (1950).

Type: REP. SOUTH AFRICA: Namaqualand, Springbok, [no date], leg. P.v.d. Byl 1147 (W!, holotype) - [containing confluent acid, 2'-O-methylmicrophyllinic acid and 2'-O-methylperlatolic acid (traces)].

DESCRIPTION:

Thallus: areolate to squamulose-areolate, up to 50 mm diam., c. 0.4 - 0.6 (- 1) mm thick.

AREOLES: angular to irregularly roundish, pale brown to brown or ochraceous, plane to subconvex, with smooth surface, c. 0.5 - 1.0 mm, max. 0.7 - 1.3 mm diam. Cortex 20 - 60 μ m thick; upper cell layer brown; hyphae c. 4 μ m diam.; epinecral layer 10 - 25 (- 40) μ m thick. Algal layer c. 50 - 120 μ m thick; algal cells c. 9 - 11 μ m, max. 13 - 15 μ m diam. Medulla I -; hyphae 3 - 4 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed, 30 - 80/cm², sessile, more or less constricted at the base or subimmersed, c. 0.5 - 0.7 mm, max. 0.8 - 1.3 mm diam. Disc plane to subconvex, black, matt, mostly epruinose. Margin at first distinct, later more or less vanishing, black, matt.

EXCIPULUM: max. 60 - 90 μ m, lateral of hymenium 40 - 75 μ m thick. Ectal zone dark grey or brown-black to green-black; pigmented zone

10 - 15 (- 20) μm tall; hyphae 4.5 - 5 μm diam., with lumina of 1.2 - 2 μm . Inner zone grey, brown or red; hyphae c. 3 - 4.5 μm diam., with lumina of 1.2 - 2.5 μm . Medullary zone more or less developed.

HYPOTHECIUM: dark brown, 100 - 300 μm tall; hyphae c. 4 μm diam.; subhymenial layer colourless to red, 15 - 25 μm tall.

HYMENIUM: 45 - 70 μm tall, colourless to reddish, I+ blue, I_{conc.}+ red-brown. Epithymenium green-black to black, 10 - 15 (- 20) μm tall. Paraphyses more or less branched, rarely anastomosing, 1.5 - 2.3 μm , apices 2 - 4 μm thick. Asci c. 35 - 45 x 7.5 - 12 μm ; tholus max. c. 7 μm , min. c. 3 μm thick; outer amyloid wall layer I+ blue, I_{conc.}+ red-brown. Spores ellipsoid, 9 - 14.5 x 3 - 4.5 (- 6) μm .

Pycnidia: immersed. Conidia 7 - 8 x 1 - 1.2 μm .



Map 34. Distribution of *Lecidea tragorum* in continental Australia

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K- ($\pm$ reddish), P-, C-.

Two chemotypes observed:

- a) containing confluent acid and 2'-O-methylmicrophyllinic acid (in 4 specimens examined, the type material containing additional traces of 2'-O-methylperlatolic acid);
- b) containing no lichen substances (17 specimens examined).

DISTRIBUTION:

Southern xeric. *L. tragorum* is distributed in South Africa (Cape Prov.) and in Southern Australia (W.A., S.A., Vic.) (map 34), occurring on siliceous rock in (sub-)arid regions. No records exist from Tasmania and New Zealand. In Australia, this species differs clearly from *L. sarcogynoides* in its distribution, which obviously is less able to tolerate arid climatic conditions and also occurs in the Northern Hemisphere.

NOTES:

The species shows a combination of anatomical characters similar to those of *L. sarcogynoides*, but is characterized by a well developed brownish thallus and a different distribution. *L. capensis*, with similar morphology, contains 2'-O-methylperlatolic acid and is distinguished from *L. tragorum* by its different distribution within Australia. For further discussions refer to *L. sarcogynoides*.

SPECIMENS EXAMINED:

Western Australia: Near Kalgoorlie, [30°45'S, 121°28'E], vii.1982, leg. M.F.Day, JAE 10285, 10863, 10865 (ANUC); -- 210° magnetic from Kalgoorlie, Ni smelter to the E of Mt Hunt, 29.ii.1980, leg. D.H.S.Richardson 17 (PERTH).

South Australia: Flinders Ranges, Echo Camp Road, 3 km N of Arkaroola, 30°19'S, 139°22'E, 400 m, 31.x.1984, leg. J.A.Elix 18026 (ANUC); -- Flinders Ranges, Nepabunna, [30°35'S, 138°59'E], 19.v.1973, leg. N.N. Donner 4227A (AD); -- Flinders Ranges, 4.5 km S of Beltana, 30°50'S, 138°24'E, 230 m, 30.x.1984, leg. J.A.Elix 17977 (ANUC); -- Flinders Ranges National Park, Parachilna Gorge, 19 km W of Blinman, 31°08'S, 138°31'E, SW exposed rocks beside road, 250 m, 7.iv.1986, leg. G.Rambold 5467, 5468 (M); -- Flinders Ranges, Bunyeroo Gorge Road, 8 km N of Wilpena, 31°25'S, 138°36'E, 550 m, 29.x.1984, leg. J.A.Elix 17879, 17884 (ANUC); -- Flinders Ranges, Moralana Gorge Road, 35 km N of Hawker, 31°35'S, 138°28'E, 320 m, 28.x.1984, leg. J.A.Elix 17826, 17837 (ANUC); -- Flinders Ranges, lower slopes of Mt Remarkable, Melrose, 32°50'S, 138°11'E, 500 m, 26.x.1984, leg. J.A.Elix 17750 (ANUC).

Victoria: 2 km NE of Suggan Buggan, [36°56'S, 148°21'E], 600 m, 21.ix.1978, leg. J.A.Elix 5003 (ANUC).

***Lecidea* subg. *Rehmiopsis* (Müll.Arg.) Rambold & Pietschmann**

= *Zosterodiscus* Hertel

HERTEL, Beih. Nova Hedwigia 79: 424 - 425 (1984).

Typus generis: *Zosterodiscus lygomma* (Nyl.) Hertel [= *Lecidea lygomma* Nyl.] - (holotype).

= *Nothoporpida* Hertel

HERTEL, Beih. Nova Hedwigia 79: 461 (1984).

Typus generis: *Nothoporpida irrubens* (Zahlbr.) Hertel [= *Lecidea lygomma* Nyl.] - (holotype).

***Lecidea atrobrunnea* (Ram. ex Lam & DC.) Schaer.**

SCHAERER, Lich. Helvet. Spicileg. 3: 134 (1828); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 522 - 524 no. 6304 (1925); 8: 333 (1932); 10: 299 (1940); ANDERSON, Genus *Lecidea* Rocky Mtn Nat. Park: 47 - 49 (1963); HERTEL, Mitt. Bot. Staatssamml. München 12: 458 (1976); Khumbu Himal 6(3): 230 - 234 (1977); Herzogia 5: 456 (1981); INOUE, Journ. Sci. Hiroshima Univ. Ser. B, Div. 2, 18: 25 - 26 (1982); SANTESSON, Lich. Sweden Norway: 159 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 57 (1986); Checklist Austr. Lich. 3. ed.: 18, 101 (1988).

= *Rhizocarpon atrobrunneum* Ram. ex Lam. & DC., Fl. Franc., ed. 3, 2: 367 (1805).

Type: "Alpes". ["Elle a été trouvée sur des schistes micacés au sommet du pic du Midi, par le C. Ramond, et dans les Alpes, par les CC. Dufresne et Villars." - vide protologue] - (G-DC, holotype) - [fide HERTEL 1977].

DESCRIPTION:

Thallus: areolate, up to 20 - 35 mm diam., 0.1 - 0.4 mm thick.

AREOLES: roundish to angular, brown, plane, convex, rarely concave, with smooth surface, c. 0.5 - 0.8 mm, max. 0.7 - 1.3 mm diam. Cortex 15 - 30 µm thick; upper cell layer brown pigmented; hyphae c. 3.5 - 4 µm diam.; epinecral layer 30 - 90 µm thick. Algal layer c. 40 - 80 µm thick; algal cells c. 10 - 11 µm, max. 12 - 14 µm diam. Medulla I + violet; hyphae 4 - 5 µm thick.

HYPOTHALLUS: black, obvious between the areoles and/or at the thallus margin.

Apothecia: roundish to angular, dispersed to crowded, 20 - 90/cm², sessile, more or less constricted at the base, rarely subimmersed, c. 0.5 - 0.8 mm, max. 0.8 - 1.0 mm diam. Disc plane, black, matt, mostly epruinose. Margin at first distinct, mostly persistent, dark grey, matt.

EXCIPULUM: lateral of hymenium and max. 60 - 100 µm thick. Ectal zone black- green to black; pigmented zone 10 - 15 µm thick; hyphae 4 - 5 µm diam., with lumina of ca. 2 µm. Inner zone colourless to

faintly grey; hyphae 4-6 μm diam., with lumina of 2 - 3 μm . Medullary zone more or less developed.

HYPOTHECIUM: brown to pale brown, 120 - 220 μm tall; hyphae 3 - 4 μm diam.; subhymenial layer colourless to pale green, 20 - 30 μm tall.

HYMENIUM: 45 - 50 μm tall, colourless to pale green, I+ blue, Iconc.+ blue. Epihymenium blackish-green to olivaceous, 10 μm tall. Paraphyses more or less branched and anastomosing, 1.8 - 2 μm , apices 3 - 4 μm thick. Asci c. 30 - 45 x 8 - 10 μm ; tholus max. 8 - 10 μm , min. 4 - 5 μm thick; outer amyloid wall layer 0.3 - 0.8 μm thick, I+ bluish-brown to brown, Iconc.+ red-brown; non-amyloid wall layer 0.3 - 0.5 μm thick; amyloid cap 0.5 - 1.0 μm thick. Spores ellipsoid to oblong, 7.5 - 13 x 4 - 5 μm .

Pycnidia: not observed.



Map 35. Distribution of *Lecidea atrobrunnea* in continental Australia

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing 2'-O-methylperlatolic acid (17 specimens examined).

DISTRIBUTION:

Bipolar. New to Australasia! The report of *L. atrobrunnea* for Australia in FILSON (1986a, 1988a) refers to South Australian material, which has not been seen by the author. It certainly does not belong to this taxon, because in continental Australia this alpine species has only been found in the Snowy Mountains and the Victorian Alps above c. 1700 m (map 35). According to HERTEL (1977: 232), *L. atrobrunnea* is widely distributed in the alpine and arctic areas of the Northern and Southern Hemisphere, growing on exposed siliceous rocks.

NOTES:

The species is well characterized by its brown thallus, the production of 2'-O-methylperlatolic acid and an amyloid medulla. A (mostly thinner) epinecral layer is also developed in lowland representatives of *Lecidea* s.str. (e.g. *L. atromorio*, *L. capensis*, *L. fuscoatrula* or *L. tragorum*), and in other alpine members of *Lecidea* subg. *Rehmiopsis* as well, e.g.:

L. leprosolimbata (Arnold) Poelt, containing norstictic acid (HERTEL 1977: 232), hypothecium pale brownish, occurring in Europe.

L. rapax Hertel, containing norstictic acid (HERTEL 1970a: 427), hypothecium dark brown, parasitizing species of *Aspicilia*, known from the Northern Hemisphere.

L. paupercula Th.Fr., containing stictic acid, hypothecium dark brown, occurring in northern Europe.

L. placodiiformis Hue, containing confluent acid (HERTEL 1984: 421), hypothecium colourless, occurring in Antarctica.

L. saxosa Anderson, containing norstictic acid, hypothecium pale brownish (ANDERSON 1964: 43 - 47), known from North America.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31764 (M); -- Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G. Rambold 3417, 3430 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3520, 3534, 3540 (M); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, leg. G.Rambold 3554 (M), 3567 (M, NSW); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31678 (M).

Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3119, 3132, 3133 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, on basalt, 3.i.1986, leg. G. Rambold 3065 (M); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3004, 3007, 3020 (M, MEL), 3013, 3037 (M); -- Bogong National Park, track along "The Razorback" N of Mt Hotham, 36°58'S, 147°07'E, on S-exposed low rocky outcrops beside track, 1720 m, 5.i.1986, leg. G.Rambold 3160 (M).

Lecidea cerviniicola B. de Lesd.

["*Lecidea cerviniicola*"], BOULY DE LESDAIN, Bull. Soc. Bot. France 102: 231 (1955); LAMB, Index Nom. Lich.: 343 (1963); HERTEL, Herzogia 2: 246 (1971); CULBERSON & HERTEL, Bryologist 75: 374 (1972); HERTEL, Decheniana 127: 63 (1975); Khumbu Himal 6 (3): 241 (1977).

= *Lecidea promiscua* var. *cerviniicola* (B. de Lesd.) Clauz. & Roux, Bull. Soc. Bot. Centre-Ouest, N.S., Numéro Spécial 7: 826 (1985).

Type: ITALY: Prov. Val d'Aosta: Breuil (Cervinia), sub monte Cervinia (Matterhorn), viii. 1953, leg. G. Solari (UPS, lectotype - designated in HERTEL 1977) - [fide HERTEL 1977].

DESCRIPTION:

Thallus: verrucose to cryptothalline, up to 60 mm diam., up to 0.4 mm thick.

AREOLES: angular, grey to white, plane, with rough surface, c. 0.3 - 0.5 mm, max. 0.5 - 0.8 mm diam. Cortex not distinct. Algal cells c. 10 - 11 μ m, max. 13 - 14 μ m diam. Medulla I + violet.

HYPOTHALLUS: not obvious.

Apothecia: roundish to auriculate, dispersed to crowded, 20 - 90/cm², sessile, mostly constricted at the base, c. 0.8 mm, max. 1.0 - 1.4 mm diam. Disc at first plane, later convex, black, matt, epruinose. Margin at first well developed, later mostly vanishing, black, matt.

EXCIPULUM: max. 75 - 150 μ m, lateral of hymenium 50 - 100 μ m thick. Ectal zone dark grey; pigmented zone 10 - 15 μ m thick; hyphae 3 - 4 μ m diam., with lumina of 1.5 - 2 μ m. Inner zone grey-brown or colourless; hyphae c. 4 μ m diam., with lumina of 1.5 - 2 μ m. Medullary zone not obvious.

HYPOTHECIUM: dark brown to brown, 100 - 300 μ m thick; hyphae 3 - 4 μ m diam.; subhymenial layer colourless, 20 - 25 μ m thick.

HYMENIUM: c. 50 μ m tall, colourless, I+ blue, I_{conc.}± blue. Epihymenium dark olivaceous, 6 - 12 μ m tall. Paraphyses branched at the upper part, more or less anastomosing, 1.5 - 2 μ m, apices c. 4 μ m thick. Asci c. 35 - 45 x 6 - 11 μ m; tholus max. 6 - 8 μ m, min. 2 - 5 μ m thick; outer amyloid wall layer 0.3 - 0.8 μ m thick, I+ bluish, I_{conc.}± brown; non-amyloid wall layer c. 0.1 - 0.2 μ m thick; amyloid cap c. 0.1 μ m thick. Spores oblong, 8 - 8.5 - 10.0 - 11 x 3 - 3.3 - 4 - 4.5 μ m (fig. 21).

Pycnidia: immersed. Conidia: 8 - 9.5 - 14 x 1 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing perlatolic acid (major) and anziaic acid (minor or traces) (12 specimens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! According to HERTEL (1977), the species was hitherto known from alpine habitats in Europe. Within continental Australia it has been found in the Snowy Mountain

area above c. 1900 m (map 36). Like *L. promiscens* this species prefers growing on low siliceous boulders and flat stones scattered over the ground in alpine heath. As yet there are no reports from Tasmania or New Zealand.

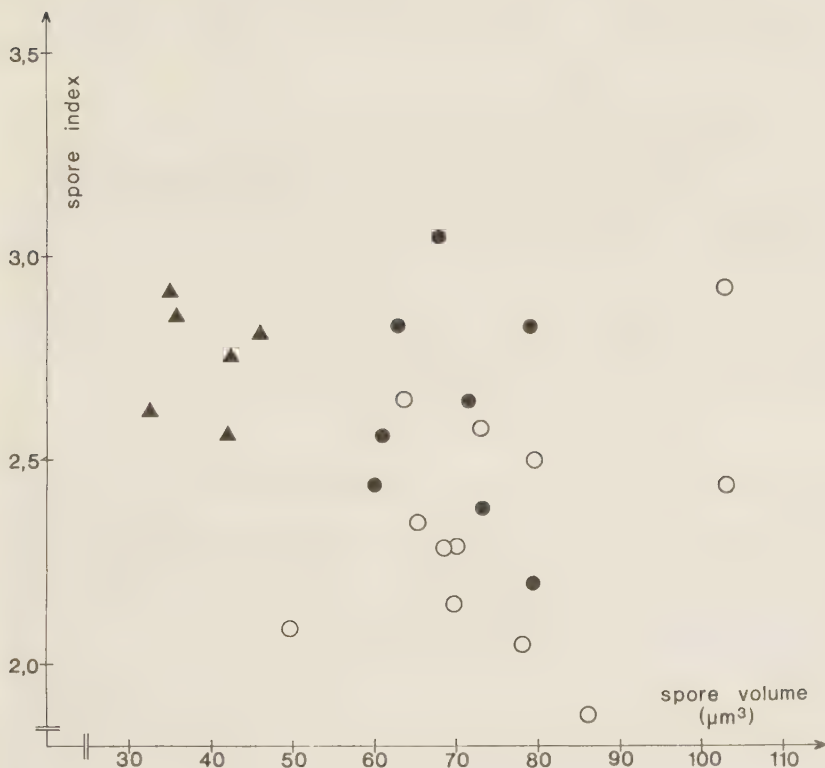


Fig. 21. Spore form and spore volume in *L. cerviniicola* [●], *L. diducens* [▲], and *L. promiscens* [○].

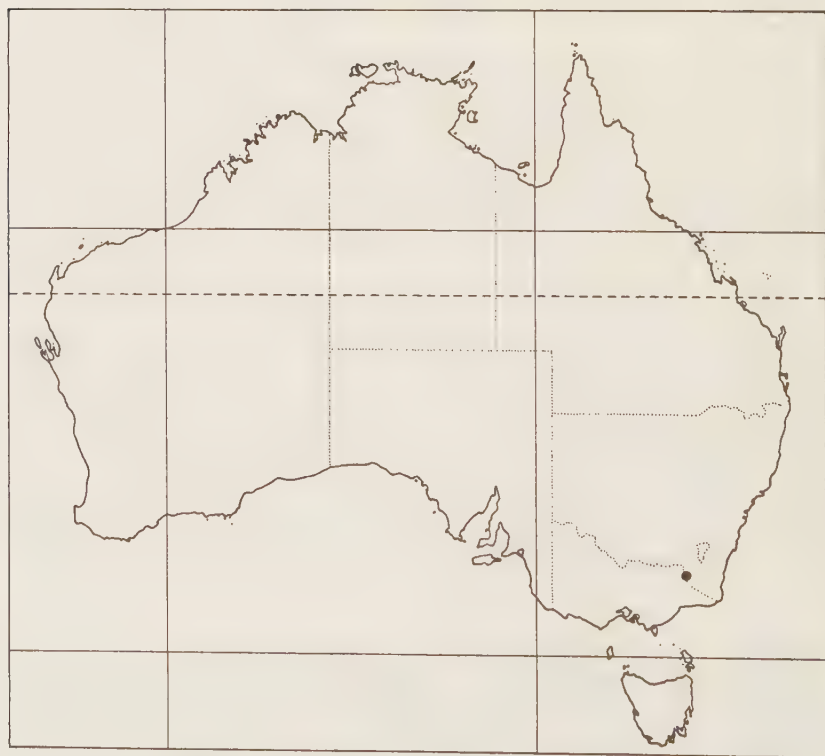
NOTES:

The Australian specimens of *L. cerviniicola* differ from the European populations by a negative C - reaction of the excipulum. The main medullary substance is perlatolic acid while anziaic acid is present in traces. Along with these two substances CULBERSON & HERTEL (1972) found atranorin in some specimens of this species, but this substance was not observed in the Australian material. The question of whether *L. promiscens* and *L. cerviniicola* represents two separate

species with related chemistry (anziaic acid as the major substance and perlatolic acid as the minor - and vice versa) or whether they are two chemical races of one species could not be finally decided. Comparative studies of the anatomical and chemical characters on a larger amount of material from both hemispheres still have to be undertaken. For the present the author has followed HERTEL (1977), who treats this taxon as a separate species. For further discussion see under *L. promiscens*.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31770 (M); -- Kosciusko National Park, Blue Lake 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3450 (M); -- Blue Lake, 7 km NE of Mt Kosciusko, 36°25'S, 148°19'E, 2000 m, 5.xii.1979, leg. H.Streimann 9564 (CBG, M); -- Kosciusko National Park, Charlottes Pass Chalet,



Map 36. Distribution of *Lecidea cerviniicola* in continental Australia

36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3532 (M, NSW); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, small rock fragments on ground, 2000 m, 17.i.1986, leg. G. Rambold 3584 (M); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, leg. G.Rambold 3561, 3576 (M, NSW), 3565, 3572 (M); -- Kosciusko National Park, summit of Mt Kosciusko, gentle slope down to a saddle above Lake Cootapatamba, 36°28'S, 148°18'E, 2150 m, 1.iii.1985, leg. H.Hertel 31689, 31700 (M); -- Kosciusko National Park, 0.4 km E of Mt Kosciusko car park, 36°28'S, 148°18'E, 2080 m, 4.xii.1975, leg. D.Verdon 1922 (CBG, M).

Lecidea crassilabra Müll.Arg.

MÜLLER ARGOVIENSIS, Hedwigia 32: 127 - 128 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 548 no. 6381 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 58 (1986); Austr. Fl. Fauna Ser. 4: 114 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).
Type: AUSTRALIA: Victoria: Mt Hotham, 6000 ft, 1890, leg. F.v.Müller (G!, holotype) - [containing stictic acid].

DESCRIPTION:

Thallus: thin, verrucose to cryptothalline, up to 70 mm diam., up to 0.25 mm thick.

AREOLES: irregularly shaped to angular, white to pale grey, sometimes rusty coloured, plane, with rough surface, up to c. 0.5 mm, max. 1.0 mm diam. Cortex c. 25 µm thick; upper cell layer not pigmented; hyphae c. 4 µm diam.; epinecral layer not developed. Algal layer up to more than c. 60 µm thick; algal cells c. 9 - 11 µm, max. 11 - 17 µm diam. Medulla I -; hyphae 4 µm thick.

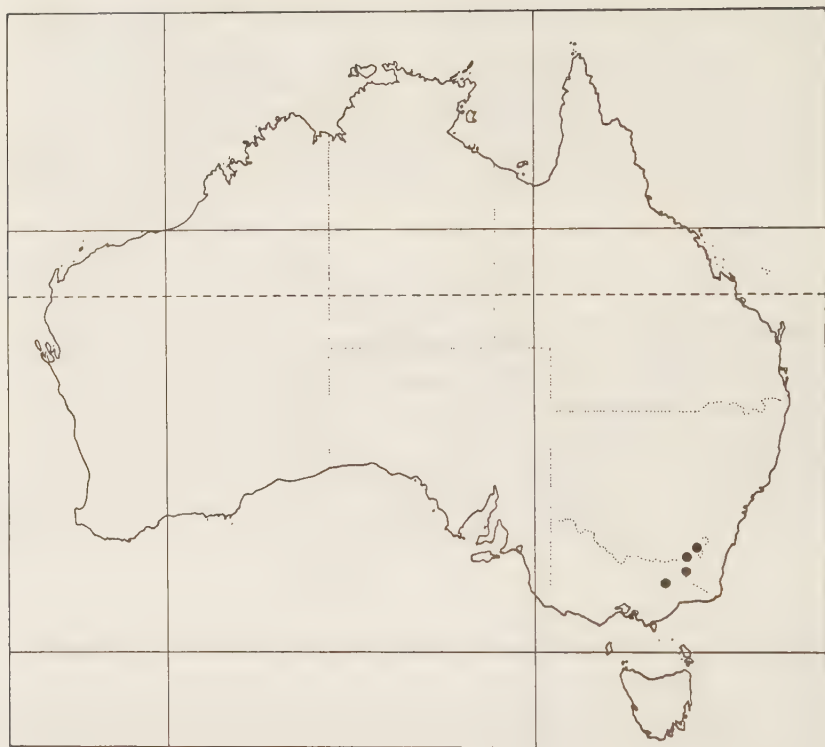
HYPOTHALLUS: not obvious.

Apothecia: roundish to angular, dispersed to crowded, 20 - 40/cm², sessile, with more or less constricted base, c. 0.6 - 1.0 mm, max. 0.7 - 1.3 mm diam. Disc plane, black, mostly matt, epruinose. Margin at first distinct, later persistent or vanishing, black, rarely nitid.

EXCIPULUM: max. 100 - 150 µm, lateral of hymenium 100 - 150 µm thick, sometimes completely reduced. Ectal zone black to brown-black; pigmented zone 15 - 40 µm thick; hyphae 4 µm diam., with lumina of 2 µm. Inner zone grey-brown to colourless; hyphae 4 - 5 µm diam., with lumina of 1 - 2 µm. Medullary zone well developed.

HYPOTHECIUM: dark brown (K± violet-brown at the basal part), 120 - 250 µm tall; hyphae 3 - 4 µm diam.; subhymenial layer colourless, 15 - 25 µm tall.

HYMENIUM: 65 - 80 µm tall, colourless, I+ blue, Iconc.+ blue. Epihymenium brownish-green, 10 - 15 µm tall. Paraphyses occasionally branched, sometimes anastomosing, 2 µm, apices 3 - 4 µm thick. Asci c. 50 - 65 x 11 - 13 µm; tholus max. 9 - 12 µm, min. 5 - 6 µm thick;



Map 37. Distribution of *Lecidea crassilabra* in continental Australia

outer amyloid wall layer 0.5 - 0.8 μm thick, I+ blue, I_{conc.}+ blue-brown; non-amyloid wall layer 0.5 μm thick; amyloid cap c. 0.5 - 1 μm thick. Spores ellipsoid, 10 - 11.0 - 14.0 - 15 x 5 - 5.1 - 6.2 - 7 μm .

Pycnidia: immersed. Conidia: 9 - 10.5 - 12 x 1 μm .

CHEMISTRY:

Cortex K- , C-, P- ; medulla K-, C-, P-; excipulum K+ yellow, C-, P± orange.

One chemotype observed, containing stictic acid, constictic acid (?) and other related additional substances (35 specimens examined).

DISTRIBUTION:

Endemic (or australasian ?). *L. crassilabra* is only known from continental Australia. The species occurs in the alpine regions of the Snowy Mountains, the Victorian Alps and has been found in A.C.T. (map

37), growing mostly on siliceous low boulders and flat stones. It seems to be somewhat dependent upon soil humidity.

NOTES:

The species, together with *L. lygomma* and *L. lygommoides*, belongs to the *L. lygomma* - complex. This species group is characterized by quite broad spores, a 1+ blue hymenium, a K± violet-brown basal part of the hypothecium, and a non-amyloid medulla, by which it is mainly distinguished from the members of the *L. lapicida* - complex. *L. crassilabra* has a relatively thin thallus, sessile apothecia and contains stictic acid as the major lichen substance. *L. lygomma* shows a more or less well developed thallus, sessile, subimmersed or immersed apothecia, and contains norstictic acid or no lichen substances. The apothecia of *L. lygommoides* are subimmersed to immersed, the hymenium is taller (70 - 100 µm) and the species contains a lichen substance, probably porphyritic acid (fig. 22, p. 217).

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, 13.5 km SW of Kiandra, 35°58'S, 148°23'E, S exposed rock wall beside dam of Tumut Pond Reservoir, 1180 m, 20.i.1986, leg. G.Rambold 3731 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31746, 31748, 31750, 31751 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3526 (M, NSW), 3549 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, small rock fragments on ground, 2000 m, 17.i.1986, leg. G.Rambold 3580, 3594 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31651 (M); -- Kosciusko National Park, Mt Kosciusko, Lake Cootapatamba, 36°28'S, 148°18'E, 2050 m, 1.iii.1985, leg. H. Hertel 32083 (M); -- Kosciusko National Park, summit of Mt Kosciusko, gentle slope down to a saddle above Lake Cootapatamba, 36°28'S, 148°18'E, 2150 m, 1.iii.1986, leg. H.Hertel 31659 (Hertel, Lecideac. Exs. in prep.) (M); -- Valentine River-Junction, directly below grey Mare Hut, c. 5000 ft, 16.iii.1967, leg. R.Filson 10152 (MEL).

A.C.T.: Along Kangaroo Creek near Corrin Dam, 36 km SW of Canberra, [35°32'S, 148°50'E], 1000 m, 2.v.1982, leg. J.A.Elix 10180 (ANUC).

Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3122 (M, MEL); -- Bogong National Park, below Mt Little Feathertop, around Federation Hut, 36°54'S, 147°07'E, 1690 m, 4.i.1986, leg. G.Rambold 3152 (M); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3010, 3015, 3017, 3028, 3033, 3039 (M); -- The Razor Back, Twin Knobs, [36°58'S, 147°07'E], 5700 ft, 18.ii.1967, leg. R.Filson 9876 (MEL); -- Along Razorback at Twin Knobs, between Mt Hotham and Mt Feathertop, [36°58'S, 147°07'E], c. 5700 ft, 13.ii.1966, leg. J.H.Willis (MEL 1018536); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3089, 3092, 3098, 3099, 3100, 3103, 3105, 3108, 3109, 3114 (M); -- Mt Hotham, 36°59'S, 147°07'E, 6000 ft, 1890, leg. F.v.Mueller (type of *Lecidea crassilabra* Müll.Arg., G); -- Mt Hotham, 36°59'S, 147°07'E, 6101 ft, 16.ii.1967, leg. R.Filson 9814, 9815 (MEL).

Lecidea diducens Nyl.

NYLANDER, Flora 48: 148 (1865); HERTEL, Herzogia 1: 35 (1968); HERTEL & LEUCKERT, Willdenowia 5: 380 (1969); HERTEL, Herzogia 2: 43 - 44 (1970); CULBERSON & HERTEL, Bryologist 75: 372 - 375 (1972); HERTEL, Decheniana 127: 65 (1975); FLETCHER, Lichenologist 7: 38 (1975); HERTEL, Khumbu Himal 6(3): 243 - 244 (1977); Mitt. Bot. Staatssamml. München 13: 340, 343 - 344 (1977); Mitt. Bot. Staatssamml. München 17: 173 (1981); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2 (Bot.) 18: 30 - 31 (1982); SANTESSON, Lich. Sweden Norway: 163 (1984); SCHWAB, Mitt. Bot. Staatssamml. München 22: 322 - 324 (1986).

= *Lecidea auriculata* β. (var.) *diducens* (Nyl.) Th.Fr., Lich. Scand.: 499 (1874); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 527 (1925); 8: 333 (1932); 10: 300 (1940).

Type: GREAT BRITAIN: Channel Islands: Jersey, Noirmont Point, 1864, leg. Ch. Larbalestier 104 (H-Nyl 15.704! holotype; BM, isotype) - [excipulum C+ red].

DESCRIPTION:

Thallus: verrucose-areolate to cryptothalline, up to 80 mm diam., c. 0.2 mm thick.

AREOLES: angular, whitish-grey, white or rusty coloured, plane, with rough surface, c. 0.5 mm, max. c. 1.0 mm diam. Cortex thin; upper cell layer not pigmented. Algal cells c. 8 - 10 μm, max. 12 - 13 μm diam. Medulla I + violet.

HYPOTHALLUS: obvious between the areoles, greyish coloured.

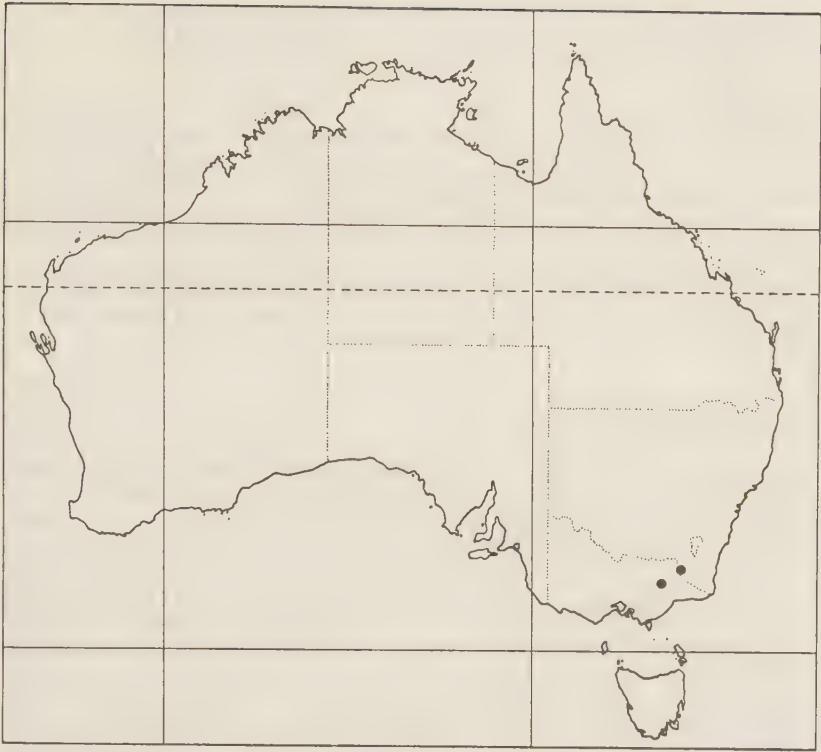
Apothecia: irregularly shaped, crowded, rarely dispersed, 35 - 60/cm², sessile, constricted at the base, c. 0.8 - 1.0 mm, max. 1.0 - 2.1 mm diam. Disc plane to convex, black, matt, epruinose. Margin at first distinct, later more or less vanishing, black, matt.

EXCIPULUM: max. 150 - 340 μm, lateral of hymenium 90 - 250 μm thick. Ectal zone brown to green-black; pigmented zone 12 - 15 (- 19) μm thick; hyphae 3.5 - 4 μm diam., with lumina of 1.2 - 2 μm. Inner zone pale brown, grey to colourless; hyphae parallel 4 - 5 μm diam., with lumina of 0.8 - 1 μm. Medullary zone mostly not developed.

HYPOTHECIUM: light brown to brown, 100 - 250 μm thick; hyphae c. 3 μm diam.; subhymenial layer pale green, (5 -) 10 - 12 μm thick.

HYMENIUM: 40 - 50 μm tall, colourless to greenish, I+ blue, Iconc.± blue. Epihymenium dark green to black, 9 - 12 μm tall. Paraphyses rarely branched, mostly not anastomosing, 1.5 - 2 μm, apices 3 - 4 μm thick. Asci c. 30 - 40 x 7 - 8 μm; tholus max. 7 - 9 μm, min. (2 -) 4 - 6 μm thick; outer amyloid wall layer 0.2 - 0.4 μm thick, I+ bluish-brown, Iconc.+ brown; non-amyloid wall layer c. 0.1 - 0.3 μm thick; amyloid cap 0.1 - 0.3 thick. Spores oblong, 6.5 - 7.3 - 8.5 - 10 x 2.5 - 3 μm (fig. 21).

Pycnidia: immersed. Conidia 11 - 13.5 - 16 x 1 μm.



Map 38. Distribution of *Lecidea diducens* in continental Australia

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C+ red, P-.

One chemotype observed, containing 2'-O-methylanziatic acid (7 specimens examined).

DISTRIBUTION:

Bipolar. New for the Southern Hemisphere! According to HERTEL (1977: 244) *L. diducens* is widely distributed in the Northern Hemisphere. Reports exist from the circumpolar Arctic region and from alpine habitats in Europe and Asia. Within continental Australia it has been found in the alpine zone of the Snowy Mountains (N.S.W., Vic.), growing on horizontal and vertical, more or less exposed surfaces of siliceous rock (map 38).

NOTES:

L. diducens is closely related to *L. auriculata* Th.Fr., which is so far

known only from the Northern Hemisphere and contains confluent acid and additional lichen substances (CULBERSON & HERTEL 1972: 374, SCHWAB 1986: 309).

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31721, 31759 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3478, 3497 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°27'S, 148°16'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31673 (M).

Victoria: Peak due E from Pretty Valley Pond, Bogong Highplains, [36°5(?)'S], 147°0(?)'E], 24.i.1967, leg. R.Filson 9555 (MEL); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G. Rambold 3095 (M).

Lecidea lapicida (Ach.) Ach.

ACHARIUS, Method. Lich.: 37 - 38 (1803); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 605 - 607 no. 6514 (1925); 8: 345 (1932); 10: 311 (1940); ANDERSON, Genus *Lecidea* Rocky Mtn Nat. Park: 38 - 40 (1964); HERTEL, Herzogia 2: 239 (1971); Willdenowia 6: 241 (1971); Decheniana 127: 50, 68 (1975); Khumbu Himal 6 (3): 256 - 259 (1977); Mitt. Bot. Staatssamml. München 17: 174 (1981); HERTEL & ZHAO, Lichenologist 14: 147 - 148 (1982); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot., 18: 38 - 39 (1982); SANTESSON, Lich. Sweden Norway: 168 (1984); HERTEL, Beih. Nova Hedwigia 79: 419 - 420 (1984); Mitt. Bot. Staatssamml. München 21: 323 (1985); GALLOWAY, Fl. New Zeal. Lich.: 634 (1985); SCHWAB, Mitt. Bot. Staatssamml. München 22: 324 - 342; HERTEL, Mitt. Bot. Staatssamml. München 23: 326 - 327 (1987); EGAN, Bryologist 90 (2): 119 (1987).

= *Lichen lapicida* Ach., Lich. Suec. Prodr.: 61 (1798).

= *Lecidea contigua* var. *lapicida* (Ach.) Nyl., Mem. Soc. Sci. Nat. Cherbourg 3: 184 (1855).

Type: SWEDEN: [no locality, no date, no collector], (H-Ach., lectotype - designated in HERTEL 1977).

= *Lecidea lapicida* var. *pantherina* Ach.

ACHARIUS, Kongl. Svensk Vetensk. Akad. Nya Handl. 1808: 232 (1808).

= *Lecidea pantherina* (Ach.) Th.Fr., Lich. Scand.: 491 - 494 (1874); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 647 - 650 no. 6622 (1925); 8: 352 (1932); 10: 317 (1940); ANDERSON, Genus *Lecidea* Rocky Mtn Nat. Park: 35 - 37 (1964).

Type: SWITZERLAND: [no locality, no date], leg. J. Schleicher 440 (H-Ach., lectotype - designated in HERTEL 1977).

= *Lecidea lactea* Flk. ex Schaer.

SCHAERER, Helvet. Spicileg.: 127 - 128 (1828); HERTEL, Herzogia 3: 378 (1975); Khumbu Himal 6 (3): 253 - 256 (1977); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 18: 35 - 37 (1982); SANTESSON, Lich. Sweden Norway: 168 (1984).

= *Lecidea ambigua* var. *lactea* (Schaer.) Fr., Summa Veget. Scand., sect. 1: 116 (1846).

= *Lecidea lapicida* var. *lactea* (Schaer.) V. Wirth, Fl. Baden-Württemb.: 511 (1987).

Type: SWITZERLAND: Kanton Bern: Berner Alpen, "Grimsel", [no date, no collector]. Protologue: "ad saxa granitica in m. [= monte] Grimsel praesertim circa Guttanen", SCHAERER, Lich. Helvet. no. 176 (M!, isotype) - [containing norstictic acid].

DESCRIPTION:

Thallus: rimose to areolate, up to 80 mm diam., 0.1 - 0.6 mm thick.

AREOLES: irregularly shaped to angular, white, grey or more or less rusty coloured, plane, with rough surface, c. 0.3 - 0.7 mm, max. 0.7 - 1.8 mm diam. Cortex 15 - 30 μ m thick; upper cell layer grey pigmented; hyphae c. 3 - 4 μ m diam.; epinecral layer rarely developed, up to 5 μ m thick. Algal layer c. 70 - 100 μ m thick; algal cells c. 9 - 12 μ m, max. 11 - 15 μ m diam. Medulla I + violet; hyphae c. 4 μ m thick.

HYPOTHALLUS: mostly not obvious, rarely between the areoles and/or at the thallus margin.

Apothecia: roundish to angular, mostly crowded, 15 - 90/cm², sessile and not constricted at the base to subimmersed, c. (0.4 -) 0.6 - 1.1 mm, max. (0.5 -) 0.8 - 1.6 mm diam. Disc plane, black, matt, epruinose, rarely light pruinose. Margin distinct and persistent, black to greyish-black, matt.

EXCIPULUM: max. 50 - 130 μ m, lateral of hymenium 50 - 130 μ m thick. Ectal zone grey-green to green-black; pigmented zone 10 - 20 μ m thick; hyphae 4 - 5 μ m diam., with lumina of 1 - 2 μ m. Inner zone colourless to grey; hyphae 4 - 5 μ m diam., with lumina of 1 - 2 μ m. Medullary zone mostly well developed.

HYPOTHECIUM: brown to light brown, occasionally colourless, c. 100 - 250 μ m tall; hyphae 3 μ m diam.; subhymenial layer colourless to pale brownish, 25 - 55 μ m tall.

HYMENIUM: c. 50 - 70 μ m tall, colourless, I+ blue, Iconc.+ bluish. Epihymenium brownish-green, dark green to blackish, 10 - 15 μ m tall. Paraphyses rarely branched and anastomosing, 1.5 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 35 - 55 x 10 - 14 μ m; tholus max. 8 - 14 μ m, min. 3 - 8 μ m thick; outer amyloid wall layer 0.5 - 1.0 μ m thick, I+ brown, Iconc.+ red-brown; non-amyloid wall layer 0.5 μ m thick. Spores ellipsoid, 9 - 13.5 x 5 - 7 μ m.

Pycnidia: immersed. Conidia 12 - 14 - 17 x 1 μ m.

CHEMISTRY:

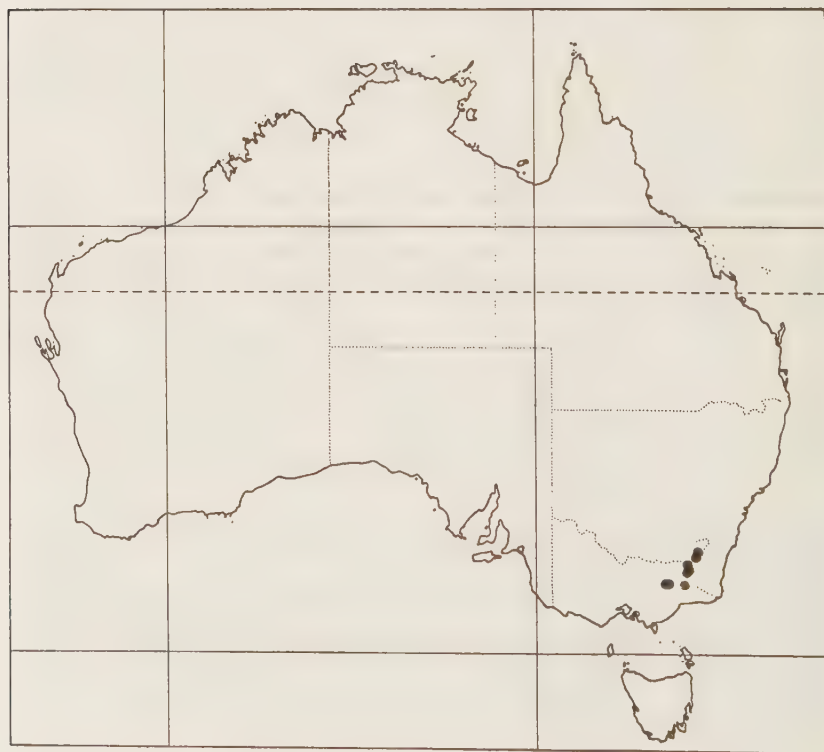
Cortex K± yellow or K+ red, C-, P± yellow to orange; medulla K-, C-, P-; excipulum K± yellow or K+ red, C-, P± yellow to orange.

Two chemotypes observed:

- a) containing stictic acid (major), constictic acid and related additional substances (28 specimens examined);
- b) containing norstictic acid (major), connorstictic acid (minor) (21 specimens examined).

DISTRIBUTION:

Bipolar. New to Australia! *L. lapicida* is a common species of the alpine regions in both hemispheres. Notes on its distribution have been given by HERTEL (1971b, 1975a, 1977, 1981b, 1984, 1985), HERTEL & ZHAO (1982) and SCHWAB (1986: 335 - 336) and are summarized in HERTEL (1987b: 326). The species has been found in the European Alps, Scandinavia, Great Britain, Greenland, North America, Venezuela and Asia. For the Southern Hemisphere, it is known from Argentina, King George Island, the Prince Edward Islands, New Zealand and



Map 39. Distribution of *Lecidea lapicida* in continental Australia

Antarctica. Within continental Australia, *L. lapicida* can be found above 1500 m in the alpine zone of the Victorian Alps, the Snowy Mountains and the Brindabella Range (N.S.W., A.C.T., Vic.) (map 39). It prefers larger siliceous stones or low boulders mostly in quite exposed position and does not seem to be as closely dependent upon soil humidity as the species of the *L. lygomma*-complex.

NOTES:

The author follows the concept of SCHWAB (1986), who regards the norstictic acid containing specimens of the *L. lapicida* - complex ("*Leicidea lactea*") as conspecific with the stictic acid containing specimens (*L. lapicida* s.str.). The Australian material doesn't show any significant anatomical or ecological differences between the two chemical strains.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, [stict.], leg. G.Rambold 3758 (M); -- Mt Jagungal, [36°09'S, 148°23'E], 6700 ft, 16.iii.1967, [stict.], leg. R.Filson 10193 (MEL); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, c. 1620 - 1680 m, 3.iii.1985, [stict.], leg. H.Hertel 31846 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, [stict.], leg. H.Hertel 31762 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, [norst.], leg. G.Rambold 3414, 3453 (M); -- Blue Lake, 7 km NE of Mt Kosciusko, 36°24'S, 148°19'E, 2000 m, 5.xii.1979, [norst.], leg. H.Streilmann 9570 (CBG, M); -- Kosciusko National Park, fieldmark between Mt Northcote and Mt Lee, [36°25'S, 148°17'E], 6500 ft, 5.iii.1968, [stict.], leg. W.A.Weber & D.McVean (COLO L-49754); -- Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake, 1720 m, 14.i.1986, [stict.], leg. G.Rambold 3464 (M); -- Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake, 1720 m, 14.i.1986, [stict.], leg. G.Rambold 3474, 3475 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, [norst.], leg. G.Rambold 3485, 3494 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, [stict.], leg. G.Rambold 3527 (M), [norst.], leg. G.Rambold 3538, 3539 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, N exposed vertical and overhanging rock wall beside track, 2000 m, 17.i.1986, [stict.], leg. G.Rambold 3590, 3593, 3599, 3600 (M); -- Near Snowy River Bridge, 2.8 km E of Mt Kosciusko, [36°26'S, 148°19'E], 1930 m, 9.ii.1978, [norst.], leg. J.A.Elix 4294 (ANUC); -- Kosciusko National Park, main ridge Mt Kosciusko along trail to Northcote Pass, [36°26'S, 148°16'E], 7000 ft, 10.xi.1967, [stict.], leg. W.A.Weber & D.McVean (COLO L-47193); -- Kosciusko National Park, trail from Charlottes Pass to Blue Lake, [36°26'S, 148°19'E], 6500 ft, 8.ii.1968, [stict.], leg. W.A.Weber & D.McVean (COLO L-49839); -- Kosciusko National Park, Mt Kosciusko summit road, 3 km from Charlottes Pass, 36°27'S, 148°18'E, 1907 m, 5.xii.1980, [norst.], leg. D.Verdon 4686 (CBG, H, NICH); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, [stict.], leg. G.Rambold 3557 (M); -- Kosciusko National Park, Mt

Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, [stict.], leg. G.Rambold 3559 (M); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, [norst.], leg. G.Rambold 3566, 3568, 3569 (M); -- Kosciusko National Park, summit of Mt Kosciusko, [36°27'S, 148°16'E], 15.i.1899, [stict.], leg. J.H.Maiden (NSW 180234); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, [stict.], leg. H.Hertel 31686, 31668 (M); -- Carruthers Peak, 7042 ft, 13.iii.1967, [stict.], leg. R.Filson 10058 (MEL); -- Mt Gungartan, 6788 ft, 18.iii.1967, [norst.], leg. R.Filson 10256 (MEL). A.C.T.: Brindabella Range, Ginini Flats, 1540 m, 28.iii.1979, [stict.], leg. J.A.Elix 5908 (ANUC); -- Bimberi Peak, 35°40'S, 148°48'E, 1800 - 1880 m, 20.x.1981, [stict.], leg. V.Wirth 11073 (STU). Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, [norst.], leg. G.Rambold 3137 (M); -- Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, [stict.], leg. G.Rambold 3144 (M); -- Bogong National Park, Mt Feathertop, beside track on SW slope below summit, 36°54'S, 147°08'E, NE exposed rocks in alpine heath, 1858 m, 4.i.1986, [stict.], leg. G.Rambold 3150 (M); -- Bogong High Plains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, 1610 m, 26.ii.1985, [stict.], leg. H.Hertel 31414 (M); -- [norst.], leg. H.Hertel 31415, 31426 (M); -- Mt Wombargo near Rocky Plains, 36°56'S, 148°12'E, c. 1400 m, 27.ii.1985, [stict.], leg. H.Hertel 31529 (M); -- [norst.], leg. H.Hertel 31520 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, [norst.], leg. G.Rambold 3067, 3075 (M); -- Bogong Highplains, Mt Painter South, 6125 ft, 26.i.1967, [stict.], leg. R.Filson 9618 (MEL); -- Bogong Highplains, Mt Jim, 5915 ft, 27.i.1967, [norst.], leg. R.Filson 9635 (MEL); -- Northern end of Cross Cut Saw, between Mt Howitt and Mt Speculation, 14.ii.1967, [stict.], leg. R.Filson 9744 (MEL); -- Between Kelly's Hut and Shaws Creek Gorge, Bennison Plains area, c. 5000 ft, 14.iii.1966, [stict.], leg. J.H.Willis (MEL 1031070).

Lecidea lygomma Nyl. in Croub.

NYLANDER in CROMBIE, J. Bot. 13: 334 (1875); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 625 - 626 no. 6548 (1925); HERTEL, Mitt. Bot. Staatssamml. München 23: 327 - 329 (1987).

≡ *Aspicilia lygomma* (Nyl.) Dodge, B.A.N.Z.A.R.E. Rep. Ser. B, 7: 164 - 165 (1948).

≡ *Zosterodiscus lygomma* (Nyl.) Hertel, Beih. Nova Hedwigia 79: 425 - 426 (1984).

Type: KERGUELEN: Observatory Bay, [no date], leg. A.E.Eaton (BM, lectotype; BM ex K islectotype - designated in DODGE 1948: 165).

= ? *Lecidea confoederata* Zahlbr.

ZAHLBRUCKNER, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 104: 299 - 300 (1941) [reprints: p. 51 - 52]; LAMB, Index Nom. Lich.: 345 (1963); HERTEL, Beih. Nova Hedwigia 79: 461 (1984) - sub *N. irrubens*; GALLOWAY, Fl. New Zeal. Lich.: 228 - 229, 633 (1985).

Type: NEW ZEALAND: South Island: Otago, Abbott's Hill near Dunedin, on rock, viii.1933, leg. J.S.Thomson 186 (W, lectotype - designated in HERTEL 1984) - [fide HERTEL (1984)].

= ? *Lecidea charadroides* Zahlbr.

Zahlbruckner, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. **104**: 300 (1941) [reprints: p. 52]; Lamb, Index Nom. Lich.: 343 (1963); Hertel, Beih. Nova Hedwigia **79**: 462 (1984) - sub *N. irrubens*; Galloway, Fl. New Zeal. Lich.: 227, 633 (1985).

Type: NEW ZEALAND: North Island: Wellington, Tararua Range, Mt Dinnan, 1200 m, on granite rock, ix.1933, leg. E. Chamberlain 190 (W, lectotype - designated in Hertel 1984) - [fide Hertel (1984)].

= *Lecidea irrubens* Zahlbr.

Zahlbruckner, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. **104**: 302 - 303 (1941); Lamb, Index Nom. Lich.: 360 (1963); Galloway, Fl. New Zeal. Lich.: 234 (1985); Hertel, Mitt. Bot. Staatssamml. München **23**: 328 (1987) - pro syn.

= *Nothoporpida irrubens* (Zahlbr.) Hertel, Beih. Nova Hedwigia **79**: 461 - 462 (1984).

Type: NEW ZEALAND: South Island: Otago, Abbott's Hill near Dunedin, on rock, [no date], leg. J.S. Thomson 183 (W 1935/2368, lectotype - designated in Hertel 1984) - [fide Hertel (1984)].

= ? *Zosterodiscus russellii* Hertel

Hertel, Beih. Nova Hedwigia **79**: 426 - 427 (1984).

Type: MARION ISLAND: Tafelberg, 46°53'S, 37°48'30"E, windexponiertes, steinübersätes, von höherer Vegetation nahezu freies Plateau, 350 m, an losen, kleinen Basaltplatten ("grey lava"), 10.v.1982, leg. H. Hertel 24574 (M, holotype) - [fide Hertel (1984), no detectable lichen substances found by TLC].

DESCRIPTION:

Thallus: areolate, up to 60 mm diam., 0.2 - 0.7 mm thick.

AREOLES: angular, white, pale grey or pale creamy, often more or less rusty coloured, plane, with rough, sometimes smooth surface, c. 0.5 - 0.8 mm, max. 0.8 - 1.8 (- 2.0) mm diam. Cortex c. 20 - 50 µm thick; upper cell layer unpigmented to grey-brown; hyphae c. 3 - 5 µm diam.; epinecral layer not developed. Algal layer c. 70 - 100 µm thick; algal cells c. 9 - 12 µm, max. 11 - 16 µm diam. Medulla I -; hyphae 3 - 5 µm thick.

HYPOTHALLUS: dark grey, sometimes obvious at the thallus margin, often not developed.

Apothecia: roundish to angular, mostly crowded, 10 - 50/cm², sessile and more or less constricted at the base or immersed, c. 0.5 - 1.0 mm, max. 0.8 - 2.5 mm diam. Disc plane to slightly convex, black, matt, sometimes with rusty pruina. Margin at first indistinct or developed, later more or less persistent or vanishing, black, matt.

EXCIPULUM: max. 60 - 130 µm, lateral of hymenium 60 - 130 µm thick, occasionally reduced. Ectal zone dark grey, brown to brown-black; pigmented zone 13 - 20 µm thick; hyphae (3 -) 4 µm diam., with

lumina of 1.2 - 2 μ m. Inner zone colourless, pale brown, grey, to brown-black; hyphae 4 - 5 μ m diam., with lumina of 1.5 - 2 μ m. Medullary zone well developed.

HYPOTHECIUM: dark brown, 130 - 450 μ m thick; K $\pm$ violet-brown; hyphae 3 - 3.5 (- 4) μ m diam.; subhymenial layer colourless to weakly tinged brown, 25 - 60 μ m tall.

HYMENIUM: 60 - 100 μ m tall, colourless, I+ blue, Iconc. $\pm$ blue. Epithymenium green, olivaceous to light brown, 12 - 15 μ m tall. Paraphyses branched and anastomosing, 1.5 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 45 - 65 x 11 - 18 μ m; tholus max. 7 - 15 μ m, min. 3 - 7 (- 8) μ m thick; outer amyloid wall layer 0.5 - 0.8 μ m thick, I+ bluish-brown, Iconc.+ (red-) brown; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 11 - 10.6 - 14.9 - 17 x 5 - 5.1 - 7.4 - 8.5 μ m (fig. 22).

Pycnidia: immersed. Conidia 8 - 9 - 10.3 - 11.5 x 1 μ m.

CHEMISTRY:

Cortex K- or K+ red, C-, P $\pm$ yellow; medulla K-, C-, P-; excipulum K $\pm$ red, C-, P-.

Two chemotypes observed:

- a) containing norstictic acid (major), connorstictic acid (minor, traces) (36 examined specimens);
- b) containing no detectable lichen substance (18 specimens examined).

DISTRIBUTION:

Austral. New to Australia! *L. lygomma* is widely distributed in the alpine zone and the subantarctic region of the Southern Hemisphere. According to HERTEL (1984, 1985, 1987b) it is known from New Zealand, Campbell Island, Macquarie Island, Kerguelen, Marion Island, and Prince Edward Islands. Within continental Australia the species occurs in the Victorian Alps and the Snowy Mountains above 1200 m, mostly growing on low siliceous boulders (map 40).

NOTES:

L. lygomma is characterized by a non-amyloid medulla, quite large spores, a dark brown hypothecium and by the production of norstictic acid or the lack of any lichen substances. Its morphological variability is quite high. Extreme growth forms from the Subantarctic Islands with subimmersed apothecia and a flat, disc-like margin have led to the description of the genus *Zosterodiscus*, which was subsequently reduced to synonymy with *Lecidea* by HERTEL (1987b).

L. crassilabra with stictic acid is very closely related to *L. lygomma* and perhaps only represents another chemotype of this species. However, since the two taxa have never been found growing together on one and the same rock, slight differences in their ecological requirements can be assumed. *L. lygomma* usually develops a thicker thallus, which often becomes rusty-coloured when growing on ferri-ferous substrata. Specimens of the *L. lygomma* - complex containing no lichen substances and showing very small immersed apothecia, have been described as *Zosterodiscus russellii*. Within the Australian

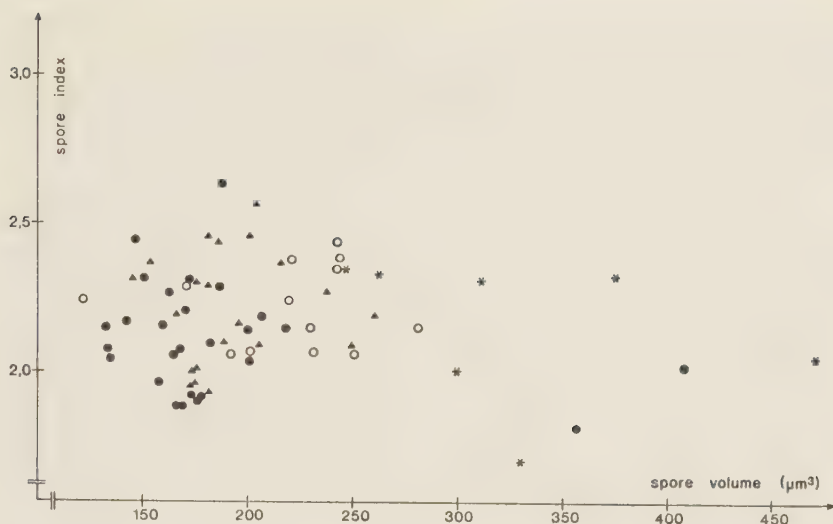


Fig. 22. Spore size and spore shape in *Lecidea lygomma* agg.: *L. lygomma* (containing norstictic acid) [●], *L. lygomma* (containing no lichen substances) [○], *L. crassilabra* (containing stictic acid) [▲], *L. lygommoides* (containing porphyritic acid) [*].

material of the *L. lygomma* agg., a correlation of apothecium size and the presence or absence of norstictic acid could not be observed. *L. lygommoides*, another member of the *L. lygomma* -complex, contains porphyritic acid and has larger spores and a taller hymenium. *L. charadroides*, described from New Zealand, was distinguished from *L. lygomma* by larger spores. HERTEL (1987b: 328) calculated a spore size of $120 \mu\text{m}^3$ - $330 \mu\text{m}^3$ for *L. lygomma* and somewhat larger ones for *L. charadroides*. Within the norstictic acid containing Australian material of this aggregate, two specimens with a spore size exceeding $330 \mu\text{m}^3$ have been found (fig. 22), but they did not show any other correlating differences. On the basis of Australian material, a final segregation of the *L. lygomma* - complex was not possible.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, 13.5 km SW of Kiandra, 35°58'S, 148°23'E, S exposed rock wall beside dam of Tumut Pond Reservoir, 1180 m, 20.i.1986, leg. G.Rambold 3726 (M); -- [no subst.], leg. G.Rambold 3727 (M); -- Kosciusko National Park, summit of Round Mtn, 28 km NE of Khancoban, 36°17'S, 148°35'E, 1750 m, 10.iv.1985, leg. J.A.Elix 19087 (ANUC); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega, 36°22'S, 148°24'E, c. 1620 - 1680 m, 3.iii.1985, [no subst.], leg. H.Hertel 31826 (M); -- Kosciusko National Park, Perisher Creek between Smiggin Holes and Guthega; 36°22'S, 148°24'E, c. 1620 - 1680 m, 3.iii.1985, leg. H.Hertel



Map 40. Distribution of *Lecidea lygomma* in continental Australia

31818, 31825, 31828, 31843 (M); -- Kosciusko National Park, Diggers Creek, near road to Charlottes Pass, 36°22'S, 148°29'E, c. 1500 m, 1. - 3.iii.1985, leg. H.Hertel 32043, 32051 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, [no subst.], leg. H.Hertel 31772 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, [no subst.], leg. G. Rambold 3460 (M, NSW); -- Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake, 1720 m, 14.i.1986, leg. G.Rambold 3472 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, [no subst.], leg. G.Rambold 3543 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3544, 3545 (M); -- Kosciusko National Park, track from Charlottes Pass to Blue Lake, [36°26'S, 148°19'E], 6000 ft, 18.i.1968, leg. W.A.Weber & D.McVean (CANB, COLO L-49284); -- Kosciusko National Park, track from Charlottes Pass to Blue Lake, 6000 ft, 18.i.1968, [no subst.], leg.

W.A.Weber & D.McVean (COLO L-49286); -- 7 km E of Mt Kosciusko, Blue Lake, 36°29'S, 148°19'E, 1950 m, 5.xii.1979, [no subst.], leg. H. Streimann 9591 (CBG, H, US); -- Hill behind Grey Mare Hut, 5400 ft, 16.iii.1967, leg. R.Filson 10171 (MEL); -- Valentine River - Junction directly below Grey Mare Hut, 5000 ft, 16.iii.1967, [no subst.], leg. R. Filson 10155 (MEL); -- Kosciusko National Park, Snowy River Valley near Island Bend, 38°20'S, 148°28'E, 1260 - 1280 m, 3.iii.1985, leg. H. Hertel 31882 (M).

Victoria: Bogong High Plains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°54'S, 147°18'E, 1610 m, 26.ii.1985, leg. H.Hertel 31418, 31429, 31431, 31432, 31438 31443, (M); -- Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, [no subst.], leg. G.Rambold 3118, 3135 (M); -- Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3125, 3126 (M); -- Bogong National Park, below Mt Little Feathertop, around Federation Hut, 36°54'S, 147°07'E, 1690 m, 4.i.1986, [no subst.], leg. G.Rambold 3153 (M); -- Bogong National Park, Mt Loch, track below summit, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3045 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, [no subst.], leg. G.Rambold 3066 (M), 3083 (M, MEL); -- Mt Loch, [36°57'S, 147°09'E], 6114 ft, 16.ii.1967, leg. R.Filson 9830 (MEL); -- Bogong Highplains, Basalt Hill, 5550 ft, 22.i.1967, leg. R.Filson 9499 (MEL); -- Bogong Highplains, Mt Fainter, 6125 ft, 26.i.1967, leg. R.Filson 9593 (MEL); -- Bogong Highplains, Mt Fainter South, 6125 ft, 26.i.1967, [no subst.], leg. R.Filson 9594 (MEL); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3024, 3034 (M); -- 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, [no subst.], leg. G.Rambold 3031, 3041, 3042 (M), 3043 (M, MEL); -- Bogong National Park, track along "The Razorback" N of Mt Hotham, 36°58'S, 147°07'E, on S-exposed low rocky outcrops beside track, 1720 m, 5.i.1986, leg. G.Rambold 3156 (HERTEL, Lecideac. Exs. in prep.), 3162 (M); -- Along Razorback at Twin Knobs, between Mt Hotham and Mt Feathertop, [36°58'S, 147°07'E], 13.ii.1966, [no subst.], leg. J.H.Willis (MEL 1031117); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3111 (M); -- Summit of Mt Sterling, 12.ii.1967, leg. R.Filson 9696 (MEL); -- Northern Granite Knobs of The Cobberas, 6000 ft, 21.ii.1967, leg. R.Filson 9994 (MEL).

Lecidea lygommoides Rambold sp. nov.

DIAGNOSIS:

L. lygommæ Nyl. *similis est, a qua imprimis differt sporis majoribus et thallo acidum porphyriticum continenti.*

Type: AUSTRALIA: New South Wales: Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3515 (M, holotype) - [containing porphyritic acid].

DESCRIPTION:

Thallus: rimose to areolate, up to 60 mm diam., 0.2 - 0.5 mm thick.

AREOLES: angular, white, grey to rusty coloured, plane, rarely irregularly convex, with rough surface, c. 0.5 - 0.7 mm, max. 0.6 - 2.0 mm diam. Cortex: upper cell layer not pigmented, epinecral layer not developed. Algal cells c. 8 - 9 µm, max. 10 - 14 µm diam. Medulla I -.

HYPOTHALLUS: pale grey, obvious between the areoles.

Apothecia: roundish to angular, crowded, rarely dispersed, 40 - c. 200/cm², subimmersed to immersed, c. 0.5 - 0.8 mm, max. 0.5 - 1.3 mm diam. Disc plane to concave, black, matt, epruinose. Margin at first thin, later persistent or vanishing, black to pale grey, matt.

EXCIPULUM: max. 40 - 50 (- 70) μ m, lateral of hymenium up to 45 (- 70) μ m thick, often reduced. Ectal zone dark grey; pigmented zone c. 10 μ m tall; hyphae c. 5 μ m diam., with lumina of 1.5 - 2 μ m. Inner zone colourless to grey; hyphae c. 5 μ m diam., with lumina of c. 2 μ m. Medullary zone well developed.

HYPOTHECIUM: dark brown, 100 - 400 μ m tall; K + violet-brown at the basal part; hyphae c. 3 μ m diam.; subhymenial layer colourless, 20 - 30 μ m tall.

HYMENIUM: 70 - 100 μ m tall, colourless, I+ blue, Iconc.+ blue. Epihymenium olivaceous, 9 - 12 μ m tall. Paraphyses mostly branched and anastomosing, 1.5 - 2 μ m, apices 2 - 3 μ m thick. Asci c. 50 - 85 x 12 - 16 μ m; tholus max. 10 - 14 μ m, min. 5 - 8 μ m thick; outer amyloid wall layer 0.3 - 0.5 μ m thick, I+ blue- brown, Iconc.+ brown; non-amyloid wall layer 0.3 - 0.5 μ m thick. Spores 10 - 13.6 - 15.9 - 18 x 5 - 5.9 - 6.8 - 8 (- 9) μ m.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing porphyrilic acid (8 specimens examined).

DISTRIBUTION:

L. lygommoides seems to be constricted to the Snowy Mountains, growing on more or less exposed siliceous rock (map 41).

NOTES:

Endemic (or australasian or austral ?). *L. lygommoides* is closely related to *L. lygomma*. The species is characterized by a non-amyloid medulla, a dark brown hypothecium, large spores (fig. 22), a tall hymenium (70 - 100 μ m) and the presence of porphyrilic acid. *Zostero-discus russellii* Hertel, which is regarded as a possible synonym of *L. lygomma*, also has small, immersed apothecia, but, according to HERTEL (1984), shows smaller spores, a hymenium up to 70 μ m tall, and contains no lichen substances.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.III.1985, leg. H.Hertel 31717 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.I.1986, leg. G.Rambold 3418 (M, NSW); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.I.1986, leg. G.Rambold



Map 41. Distribution of *Lecidea lygommoides* in continental Australia

3515, 3519 (M); -- 1 km N of Mt Kosciusko, along the Lakes Trail, [36°26'S, 148°16'E], 2120 m, 14.iii.1979, leg. J.A.Elix 5739 (ANUC); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 2228 m, 17.i.1986, leg. G.Rambold 3562 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31665 (M).

***Lecidea plana* (Lahm) Nyl.**

NYLANDER, Flora 55: 552 (1872); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 668 - 669 no. 6647 (1925); 8: 354 (1932); 10: 318 (1940); HERTEL, Decheniana 127: 71 (1975); Khumbu Himal 6 (3): 268 - 269 (1977); CULBERSON & HERTEL, Bryologist 82: 189 - 197 (1979); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 18: 41 - 43 (1982); HERTEL, Beih. Nova Hedwigia 79: 421 (1984).

= *Lecidella plana* Lahm in Koerb., Parerga Lich.: 211 - 212 (1861).

Type: WEST GERMANY: Nordrhein-Westfalen: Stimmberg bei Oer, v.1860, leg. J.G.Lahm (B, lectotype - designated in HERTEL 1977: 268) - [fide HERTEL 1984].

DESCRIPTION:

Thallus: verrucose to cryptothalline, up to 120 mm diam., up to 0.5 mm thick.

AREOLES: irregularly shaped to angular, pale grey, plane, with rough surface, c. 0.4 - 0.5 mm, max. 0.5 - 1.0 mm diam. Algal cells c. 9 - 10 μ m, max. 10 - 11 μ m diam. Medulla I - or I+ pale violet.

HYPOTHALLUS: mostly not obvious.

Apothecia: roundish to auriculate, crowded to dispersed, 10 - 40/cm², sessile, constricted at the base, c. 1 mm, max. 1.2 - 1.6 mm diam. Disc mostly plane, black, matt, slightly pruinose or not. Margin distinct and persistent, black, matt.

EXCIPULUM: max. 80 - 110 μ m, lateral of hymenium 70 - 90 μ m thick. Ectal zone black-green to brown-black; pigmented zone 10 - 12 μ m thick; hyphae c. 4 μ m diam., with lumina of 1.5 - 2 μ m. Inner zone pale brown; hyphae 4 - 5 μ m diam., with lumina of 1.5 - 2 μ m. Medullary zone well developed.

HYPOTHECIUM: not pigmented; hyphae c. 3 μ m diam.; subhymenial layer colourless.

HYMENIUM: 55 - 65 μ m tall, colourless, I+ blue, Iconc.+ blue. Epihymenium dark green, 10 - 13 μ m tall. Paraphyses rarely branched and anastomosing, 1.7 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 40 - 50 x 9 - 12 μ m; tholus max. 8 - 9 μ m, min. 5 - 6 μ m thick; outer amyloid wall layer 0.2 - 0.5 μ m thick, I± blue, Iconc.+ brown; non-amyloid wall layer c. 0.3 μ m thick; amyloid cap c. 1 (- 2) μ m thick. Spores ellipsoid, 9 - 12.5 x 3 - 4 μ m.

Pycnidia: immersed. Conidia c. 10 - 12 x 1 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing planaiic acid, 4-O-demethylplanaiic acid (3 specimens examined).

DISTRIBUTION:

Bipolar. New to Australia! *L. plana* is widely distributed in the Northern Hemisphere from lower altitudes to the alpine zone, growing on siliceous rocks in a more or less sheltered position. HERTEL (1977: 269) examined material from North, West and Central Europe, from



Map 42. Distribution of *Lecidea plana* in continental Australia

Japan and North America and the northern Andes. HERTEL (1984: 421) reported the species as new for the Southern Hemisphere (New Zealand). In continental Australia, the species seems to be confined to the alpine zone of the Snowy Mountains (map 42).

NOTES:

L. plana is easily recognized by a mostly non-amyloid medulla, a colourless hypothecium, a greenish epihymenium and by its chemistry. The anatomical differences between *L. plana* and the closely related *L. lithophila* (Ach.) Ach., a species also containing planaic acid and 4-O-demethylplanaic acid, but only known from the Northern Hemisphere, are discussed in detail by SCHWAB (1986: 346 - 347).

SPECIMENS EXAMINED:

New South Wales: Kosciuszko National Park, Blue Lake 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3424 (M, NSW); --

Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.I.1986, leg. G.Rambold 3516, 3521 (M).

Lecidea promiscens Nyl.

NYLANDER, Flora 55: 358 (1872); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 675 - 676 no. 6671 (1925); 8: 355 (1932); HERTEL, Herzogia 2: 244 - 248 (1971) p.p.; Decheniana 127: 72 (1975); Khumbu Himal 6 (3): 272 - 274 (1977); Mitt. Bot. Staatssamml. München 17: 177 (1981); SANTESON, Lich. Sweden Norway: 173 (1984).

≡ *Lecidella promiscens* (Nyl.) Arnold, K. K. Verh. Zool.-Bot. Ges. Wien 29: 354 (1879).

≡ *Lecidea promiscua* var. *promiscens* (Nyl.) Clauz. & Roux, Bull. Soc. Bot. Centre-Ouest, N.S., Numéro Spécial, 7: 826 (1985).

Type: FRANCE: Dépt. Hts. Pyrénées: Barèges (SSE Lourdes), leg. W.Nylander (H-Nyl. 15927, holotype - growing beside the holotype of *L. promiscua* Nyl.) - [fide HERTEL 1977].

DESCRIPTION:

Thallus: rimose-areolate to cryptothalline, up to 60 mm diam., up to 0.2 mm thick.

AREOLES: angular, white to grey, plane, with rough surface, c. 0.3 mm, max. 0.5 - 0.6 mm diam. Algal cells c. 10 - 12 µm, max. 13 - 18 µm diam. Medulla I + violet.

HYPOTHALLUS: not obvious.

Apothecia: roundish to angular, mostly crowded, 40 - 100/cm², sessile, constricted at the base, c. 0.5 - 0.7 mm, max. 0.8 - 1.0 mm diam. Disc plane to convex, black, matt, epruinose. Margin at first obvious, later persistent or vanishing, black, matt.

EXCIPULUM: max. 70 - 80 µm, lateral of hymenium c. 70 µm thick. Ectal zone dark grey; pigmented zone 7 - 12 µm thick; hyphae 4 (- 5) µm diam., with lumina of 1 - 2 µm. Inner zone pale brown to colourless; hyphae 4 - 5 µm diam., with lumina of c. 2 µm. Medullary zone not obvious.

HYPOTHECIUM: brown to dark brown, 100 - 170 µm thick; hyphae c. 3 µm diam.; subhymenial layer colourless, 15 - 25 µm thick.

HYMENIUM: 45 - 55 µm tall, colourless, I+ blue, Iconc.+ blue. Epihymenium dark green-brown, 7 - 11 µm tall. Paraphyses more or less branched, rarely anastomosing, (1.2 -) 1.8 µm, apices 4 - 4.5 µm thick. Asci c. 32 - 45 x c. 10 µm; tholus max. 7 - 9 µm, min. 3 - 5 µm thick; outer amyloid wall layer c. 0.1 - 0.2 µm thick, I+ bluish-brown, Iconc.+ brown; non-amyloid wall layer c. 0.1 µm thick; amyloid cap c. 0.1 µm thick. Spores oblong, 7 - 7.3 - 11.3 - 13 x 3 - 3.4 - 3.9 - 4 µm (fig. 21).

Pycnidia: not observed.



Map 43. Distribution of *Lecidea promiscens* in continental Australia

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing confluent acid (major), 2'-O-methylperlatolic acid (minor, traces), 2'-O-methylmicrophyllinic acid (traces) (12 specimens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! According to HERTEL (1977: 273 - 274), *L. promiscens* is widely distributed in the alpine regions of the Northern Hemisphere. Reports exist for Europe (Scandinavia, Central Europe and the Mediterranean), Asia (Afghanistan) and North America (Colorado). Within continental Australia the species occurs in the alpine zone of the Snowy Mountains, growing on siliceous rock, mostly on low boulders and flat stones scattered on the floor of alpine heath (map 43).

NOTES:

L. promiscens is characterized by a relatively thin thallus, narrow spores (c. 3 - 4 μ m), a I+ blue hymenium, and an amyloid medulla. European specimens of *L. promiscens* contain porphyrilic acid, often together with confluent acid and 2'-O- methylperlatolic acid (HERTEL unpubl.). Porphyrilic acid could not be detected in the Australian material. *L. promiscens* is closely related to *L. cerviniicola*, which is preliminarily treated as a different species in this study, following HERTEL (1977). However, the Australian samples of both taxa show no significant ecological or anatomical differences, so that they probably are only chemotypes of the one species. Several specimens with more or less well developed thallus ("*Lecidea promiscua* Nyl.") were also observed among the Australian material, however they didn't show any significant anatomical differences. *L. auriculata*, a similar species known from the Northern Hemisphere, also contains confluent acid, but has narrower spores, a different excipulum structure (HERTEL 1977: 273) and a brownish subhymenium.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3444 (M); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, small rock fragments on ground, 2000 m, 17.i.1986, leg. G.Rambold 3577, 3581, 3582 (M); -- Mt Kosciusko National Park, trail above Lake Albina, [36°26'S, 148°16'E], 6500 ft, 5.iii.1968, leg. W.A.Weber & D.McVean (COLO L-49750); -- Kosciusko National Park, summit of Mt Kosciusko, gentle slope down to a saddle above Lake Cootapatamba, 36°28'S, 148°18'E, 2150 m, 1.iii.1985, leg. H.Hertel 31702 (M); -- Carruthers Peak, 7042 ft, 13.iii.1967, leg. R.Filson 10059 (MEL). Victoria: Mt Loch, [36°57'S, 147°09'], 6114 ft, 16.ii.1967, leg. R.Filson 9833 (MEL); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3018, 3021, 3032, 3036 (M); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3094 (M).

Micareaceae Vězda ex Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 306 - 307 (1984).

Type: *Micarea* Fr.

= Helocarpaceae Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 285 - 286 (1984).

Type: *Helocarpon* Th.Fr.

HAFELLNER (l.c.) has already pointed out a possible relationship between Helocarpaceae and Micareaceae. He used the development of an apothecium margin in *Helocarpon* and the lack of a distinct margin in *Micarea* for the segregation of the two families. However, there are several species of *Micarea* s.str. which show more or less well developed excipula. They are generally displaced towards the base of the

apothecia and therefore difficult to recognize macroscopically. This is even the case in the type species of *Micarea* (*M. prasina*), which shows a relatively well differentiated excipulum. For this reason, the family Helocarpaceae Hafellner is regarded as synonym to the family Micareaceae Vězda ex Hafellner.

The relations between Micareaceae and the Lecidomataceae Hafellner, Mycobilimbiaceae Hafellner, Pannariaceae Tuck., Psoraceae Fink, Psorulaceae Hafellner, Porpidiaceae Hertel & Hafellner, and some other groups with tube-like amyloid tholus structures, will be discussed in a separate study with M. Pietschmann.

***Micarea* Fr.**

FRIES, Syst. Orb. Veget.: 256 (1825); COPPINS, Bull. Brit. Mus. (Nat. Hist.), Bot. 11 (2): 17 - 214 (1983) p.p.

Typus generis: *M. prasina* Fr. - (holotype).

It is difficult to decide, whether *Micarea* is a natural unit or whether it should be divided in more entities. As it becomes obvious in COPPINS (1983, 1988), no correlations exist between substratum preference (organic or inorganic substratum), the development of a distinct excipulum and the type of the photobiont ("micareoid" algae or not) in this genus. This study, follows the concept of COPPINS (l.c.), who includes species with marginate apothecia and with non-micareoid photobionts in the genus *Micarea*.

***Micarea erratica* (Koerb.) Hertel, Rambold & Pietschmann comb. nov.**

= *Lecidea erratica* Koerb., Parerga Lich.: 223 (1861); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 575 - 576 no. 6426 (1925); 8: 341 (1932); COPPINS, Bull. Brit. Mus. (Nat. Hist.), Bot. 11 (2): 67, 187 (1983); SANTESSON, Lich. Sweden Norway: 164 (1984).

= *Lecidea parasema* var. *erratica* (Koerb.) Boist., Nouv. Flore Lich. 2: 223 (1903). [n.v.]

Type: "An umherliegenden Quarzsteinchen (Feuersteinen) bei Münster von Hrn. Lahm und an Granitgeröll eines Sandhügels bei Nimkau von mir gesammelt" (vide protologue in KOERBER 1861!) - [n.v.].

= ? *Lecidea chalybeiza* Nyl.

NYLANDER, Flora 50: 440 (1867); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 532 no. 6350 (1925); HERTEL, Khumbu Himal 6(3): 306 - 307 (1977); GALLOWAY, Fl. New Zeal. Lich.: 227 (1985).

= *Micarea chalybeiza* (Nyl.) in HERTEL, Beih. Nova Hedwigia 79: 455 (1984). - [comb. prov.].

Type: NEW ZEALAND: South Island: Otago, "ad saxa, [no date], ex herb. Jones" (H-Nyl. 20312, fragmentulum typi) - [fide HERTEL 1984].

= ? *Lecidea nigrescens* Knight

KNIGHT, Trans. Linn. Soc. London, Bot. 1: 276 (1878); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 532 (1925) - sub *L. chalybeiza*; HERTEL, Beih. Nova Hedwigia 79: 455 (1984) - sub *M. chalybeiza*.

Type: NEW ZEALAND: Near Wellington, [no date], leg. Ch. Knight (BM, M, isotypes) - [fide HERTEL 1984].

= *Lecidea tephrizans* Leight. **syn. nov.**

LEIGHTON, Trans. Linn. Soc. London, Bot. 1: 237 (1878); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 708 - 709 no. 6809 (1925); 8: 361 (1932).

Type: WALES: "Llanachar Bridge near Fishguard, Pembrokeshire", ix.1876, leg. W.A. Leighton (BM ex K, holotype) - [fide COPPINS (in litt.)].

DESCRIPTION:

Thallus: cryptothalline to verrucose, up to 70 mm diam., up to c. 0.1 mm thick.

AREOLES: irregularly shaped or not developed, grey to creamy coloured, plane, with rough surface, up to 0.2 mm diam. Cortex c. 5 μ m thick; upper cell layer grey pigmented; hyphae c. 3 μ m diam.; epinecral layer up to 7 μ m thick or not developed. Algal layer up to c. 50 μ m thick; algal cells c. 9 - 11 μ m, max. 13 - 14 μ m diam. Medulla I -; hyphae c. 3 μ m thick.

HYPOTHALLUS: black, obvious between the areoles or missing.

Apothecia: roundish, dispersed to crowded, up to 400/cm², sessile, more or less constricted at the base, c. 0.2 - 0.3 mm, max. 0.3 - 0.4 mm diam. Disc plane to subconvex, black, matt to subnitid, epruinose. Margin distinct and persistent, black, subnitid to matt.

EXCIPULUM: max. 40 - 65 μ m, lateral of hymenium 30 - 45 μ m thick. Ectal zone dark grey; pigmentation 6 - 8 μ m tall; hyphae 5 - 7 μ m diam., with lumina of c. 2 μ m. Inner zone colourless; hyphae 9 - 10 μ m diam., with lumina of (1 -) 2 μ m. Medullary zone not developed.

HYPOTHECIUM: dark brown, 40 - 80 μ m thick; hyphae 6 - 10 μ m diam.; subhymenial layer colourless to brown, 20 - 25 μ m thick.

HYMENIUM: 30 - 35 μ m tall, colourless, I+ blue-brown, Iconc.+ red-brown. Epithymenium grey to black, 6 - 10 μ m tall. Paraphyses more or less branched, rarely anastomosing, 1.5 - 1.8 μ m, apical 1.7 - 3 μ m thick. Asci c. 30 x 7 - 8 μ m; tholus max. 4 - 7 μ m, min. 2 - 5 μ m thick; amyloid tube c. 1.8 - 2 μ m broad; outer amyloid wall layer 0.2 - 0.4 μ m thick, I+ brown, Iconc. + red-brown; non-amyloid wall layer 0.2 - 0.4 μ m thick. Spores ellipsoid, 5 - 7 x 2 - 3 μ m.

Pycnidia: immersed. Conidia short cylindrical, c. 3 - 4 x 1 - 1.5 μ m (?).

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing no detectable lichen substances (2 specimens examined).

DISTRIBUTION:

Cosmopolitan (?). New to Australia! The distribution of this inconspicuous species is poorly known. Reliable reports exist from North America (HERTEL 1977), North and Central Europe (COPPINS 1983, SANTESSON 1984), New Zealand and Indonesia (Java) (HERTEL 1977). Within Australia *M. erratica* has been found in Qld, N.S.W. and Vic. (map 44), growing on small, non-calcareous stones from lower altitudes to the subalpine zone.



Map 44. Distribution of *Micarea erratica* in continental Australia

NOTES:

M. erratica is the only saxicolous lecideoid member of *Micarea* known from Australia. It is characterized by a dark brown hypothecium, a well developed excipulum, small spores, and "non-micareoid" photobionts. COPPINS (in litt.) regards this species as being relatively isolated from the species hitherto included in *Micarea* by its wide and moniliform lumina of the paraphyses (up to 2 μ m) and of the hyphae of the excipulum (reaching 2.5 μ m breadth).

SPECIMENS EXAMINED:

Queensland: Moreton Distr., Taylor's Range, [no date], leg. F.M.Bailey (?) (BRI, Bailey hb. Book. 2 p. 26).

New South Wales: Castlereagh River, 8 km W of Coonabarabran, 31°15'S, 149°11'E, on scattered loose rocks, 600 m, 26.viii.1979, leg. H. Streimann 9278 (CBG, H, NICH, TNS, US); -- 28 km SSW of Jindabyne, near Ingebyra, 36°39'S, 148°30'E, big and small granitic boulders in pasture land beside Buchan - Jindabyne road, c. 950 m, 13.i.1986, leg. G.Rambold 3375 (M).

Victoria: Great Dividing Range, along road from Benambra to Wulgulmerang near the junction of Mt Cobberas Track, 36°54'S, 148°06'E, c. 1200 m, 27.ii.1985, leg. H.Hertel 31562 (M).

Psilolechia Massal.

MASSALONGO, Atti Ist. Veneto Sci. Lett. Arti ser. 3, 5: 264 (1860); COPPINS & PURVIS, Lichenologist 19: 29 - 31 (1987); WIRTH, Flecht. Baden-Württemb.: 399 (1987).

Typus generis: *Biatora lucida* (Ach.) Fr. [= *P. lucida* (Ach.) Choisy] - (holotype).

Psilolechia lucida (Ach.) Choisy

CHOISY, Bull. Mens. Soc. Linn. Lyon 18 : 142 (1949) [Catal. Lich. Région Lyonnaise: 22 (1954)]; FILSON, Checklist Austr. Lich. 1. ed.: 96 (1983); Checklist Austr. Lich. 2. ed.: 123 (1986); Checklist Austr. Lich. 3. ed.: 25, 160 (1988).

= *Lichen lucidus* Ach., Lich. Suec. Prodrum.: 39 (1798).

= *Lecidea lucida* (Ach.) Ach., Method. Lich.: 74 (1803); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 792 - 794 no. 7121 (1925); 8: 374 (1932).

= *Biatora lucida* (Ach.) Fr., Lich. Suec. Exs., fasc. 2, no.: 42 (1818).

Type: SWEDEN: [no locality, no date, no collector], (H-Ach 243A, lectotype - designated in COPPINS & PURVIS 1987: 37).

DESCRIPTION:

Thallus: leprose, up to 70 mm diam., 0.1 - 0.3 mm thick. Algal cells c. 6.5 - 8 μ m, max. 9 - 12 μ m diam. Medulla I -; hyphae 3 - 4 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish, dispersed, 40 - 50/cm², sessile, more or less constricted at the base, c. 0.3 - 0.35 mm, max. c. 0.5 mm diam. Disc convex, yellow, matt, epruinose. Margin not obvious.

EXCIPULUM: max. 40 μ m, lateral of hymenium 20 μ m thick or reduced. Ectal zone colourless; hyphae 3 μ m diam., with lumina of c. 0.8 μ m. Inner zone colourless; hyphae 2 μ m diam., with lumina of 1.3 μ m. Medullary zone not developed.

HYPOTHECIUM: colourless, hyphae c. 3 μ m diam.; subhymenial layer colourless.

HYMENIUM: c. 25 μ m tall, colourless, I+ yellow, Iconc.+ orange. Ep-hymenium yellow incrustated, c. 5 μ m tall. Paraphyses mostly not branched and anastomosing, 1.5 - 1.8 μ m, apical 1.5 - 2 μ m thick. Asci c. 20 x 5.5 μ m; tholus max. 5 - 6 μ m, min. 2 - 4 μ m thick; outer amyloid wall layer 0.1 - 0.2 μ m thick, I+ yellowish, Iconc.+ orange; non-amyloid wall layer 0.3 - 0.4 μ m thick; amyloid tube c. 1 - 1.2 μ m broad. Spores ellipsoid, c. 4 - 5 x 1.5 - 2 μ m.

Pycnidia: not observed.



Map 45. Distribution of *Psilolechia lucida* in continental Australia

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing rhizocarpic acid (1 specimens examined).

DISTRIBUTION:

Cosmopolitan (?). *P. lucida* is a world-wide distributed species, occurring in North America, Europe, and Australasia (COPPINS & PURVIS 1987: 38). It typically grows on vertical rock surfaces or sheltered rock underhangs. According to KANTVILAS (1985), it frequently occurs in rainforest areas of Tasmania. For continental Australia, it is known only from one collection (map 45).

NOTES:

This species can easily be recognized by a yellow-green, mostly leprose thallus and, if developed, small yellowish apothecia. The specimen treated in this study is chemically identical with the type specimen, which, according to PURVIS & COPPINS (l.c.), contains rhizocarpic acid along with four unknown substances. These authors report a second chemical strain from Tasmania and New Zealand, containing additional zeorin and *Stichococcus* instead of *Trebouxia* (?) as photobiont.

SPECIMENS EXAMINED:

New South Wales: Rossi Road, under rock overhang, 35°28'S, 149°30'E, xii.1967, leg. D.McVean 67226 (CBG).

Porpidiaceae Hertel & Hafellner in Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 318 - 324 (1984); HERTEL, Beih. Nova Hedwigia **79**: 428 - 429 (1984).

Type: *Porpidia* Koerb.

= Koerberiellaceae Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 286 - 287 (1984).

Type: *Koerberiella* Stein

The actual generic concept of this lichen family (e.g. HERTEL 1984) is mainly based on the following characters:

- 1.) Thallus: colour, occurrence of cephalodia.
- 2.) Apothecia: structure of disc (gyrodisc or not), adnation, the type of excipulum, pigmentation of excipulum and the hypothecium, frequency of anastomoses of the paraphyses.
- 3.) Spores: size, development of a halonate perispore, pigmentation.
- 4.) Spermatia: form, size.
- 5.) Chemism.

Most of these features can be accepted as suitable diagnostic characters at the generic and species level within the Porpidiaceae (fig. 23, tab. 11, 12, 13a,b). Aside from these characters, the amyloid reaction of outer ascus wall, hymenial gel, and medulla, are - similar to that in the Lecideaceae - of significant value at the subgeneric as well as at the generic level.

The delimitation of the Porpidiaceae (incl. Koerberiellaceae) against the Micareaceae, Mycobilimbiaceae, Pannariaceae and Psoraceae - all with species, showing amyloid, tube-like tholus structures - will be discussed in a separate study.

The saxicolous Australian species belonging to the Porpidiaceae can be assigned to the genera *Poeltidea*, *Poeltiaria* and *Porpidia*, and to *Immersaria* and *Paraporpidia*, which are described as new.

Table 11. The main characteristics of the lecideoid species of Porpidiaceae occurring in Australia:

1.) Adnation of apothecia; 2.) amyloid reaction of the hymenium in Lugol's solution; 3.) spore walls halonate; 4.) colour of the hypothecium; 5.) colour of the thallus; 6.) development of an epinecral layer; 7.) amyloid reaction of the medulla in Lugol's solution; 8.) development of a hypothallus

[bl = blue; br = brown; dbr = dark brown; gr = green; gre = grey; i = immersed; oc = ochraceous; orr = orange red; se = sessile; si = subimmersed; up = unpigmented; w = white; yel = yellow].

1) Spores with brown pigmented walls

	Apoth. adn.	Hym. l+	Spores halonate	Hypoth. colour	Thallus colour	Epinecr. layer	Med l+	Hyp. th.
<i>Paraporpidia</i>								
<i>aboriginum</i>	se	orr	-	dbr	w/gr	-	-	-
<i>glauca</i>	se	orr	-	dbr	w/gre	-	±	-
<i>leptocarpa</i>	se/si	±	-	dbr	w/gre	-	-	±
<i>Poeltiaria</i>								
<i>coromandelica</i>	se	-	±	up	yel	-	±	±
<i>corralensis</i>	se	±	+	up	w	-	±	±
<i>turgescens</i>	se	bl	+	up	w	-	-	±
<i>Porpidia</i>								
<i>albocaerulesc.</i>	se/si	bl	+	dbr	w	-	-	-
<i>contraponenda</i>	se	bl	+	dbr	w	-	-	+
<i>crustulata</i>	se	bl	+	br	w/oc	-	-	±
<i>macrocarpa</i>	se	bl	+	dbr	w/oc	-	-	+
<i>soredizodes</i>	se	bl	+	br	w/oc	-	-	±
<i>speirea</i>	se	bl	+	dbr	w/gre	-	+	+
<i>umbonifera</i>	se	bl	+	dbr	w/gre	-	+	+
<i>Immersaria</i>								
<i>athroocarpa</i>	i	orr	+	up/br	br	+	+	+
<i>Poeltidea</i>								
<i>perusta</i>	i	bl	+ ¹⁾	up	br	+	-	+

Table 12. The distribution of lichen substances within the lecideoid species of Porpidiaceae occurring in Australia

[bour = bourgeanic acid; confl = confluentic acid; 2'-O-mp = 2'-O-methylperlatolic acid; 2'-O-mmp = 2'-O-methylmicrophyllinic acid; m 2'-O-mmp = methyl 2'-O-methylmicrophyllinate; porph = porphyrilic acid; stic/ns = stictic acid, norstictic acid; usn = usnic acid].

	Fatty acids	para-Depsides				Depsidones	Dibenzo-furans	Usnic acids
	bour	confl	2'-O-mp	2'-O-mmp	m 2'-O-mmp	stic/ns	porph	usn
<i>Paraporpidia</i>								
<i>aboriginum</i>				+				
<i>glauca</i>		+	+	+				
<i>leptocarpa</i>		+	+	+				
<i>Poeltiaria</i>								
<i>coromandelica</i>		+(?)						+
<i>corralensis</i>							+	
<i>turgescens</i>		+	+(?)	+(?)				
<i>Porpidia</i>								
<i>albocaerulesc.</i>						+		
<i>contraponend.</i>					+			
<i>crustulata</i>						+		
<i>macrocarpa</i>								
<i>soredizodes</i>	+					+		
<i>speirea</i>		+	+(?)					
<i>umbonifera</i>								
<i>Immersaria</i>								
<i>athroocarpa</i>		+	+	+		+		
<i>Poeltidea</i>								
<i>perusta</i>								

Table 13a. The main characteristics of the genera of the Porpidiaceae:
 1.) halonate structures of spore walls; 2.) amyloid reaction of hymenium in Lugol's solution; 3.) amyloid reaction of medulla in Lugol's solution; 4.) average breadth of paraphyses $> 2 \mu\text{m}$; 5.) maximal breadth of excipular hyphae $\geq 5 \mu\text{m}$; 6.) pigmentation of the hypothecium; 7.) form of conidia
 [bl = bluish; br = brownish; c = cylindrical; f = filiform; orr = orange-red; * = not reported from Australia].
 1) spore walls amyloid (l + violet)
 2) apothecia with "lecanorine" margination

	Sp. hal.	Hym. l	Med. l + viol.	Par. $\bar{Q}$ $> 2 \mu\text{m}$	Exc. hy. max. $\geq 5 \mu\text{m}$	Hypoth. pigment.	Conidia
<i>Clauzadea</i> *	+	± orr	-	+	+/-	+/-	c
<i>Schizodiscus</i> *	-	+ orr	-	-	-	±	c
<i>Amygdalaria</i> *	+	+ orr	-	-	-	+	c
<i>Bellemerea</i>	+ ¹⁾	± orr	+/-	-	-	-	c
<i>Immersaria</i>	+	± orr	+/-	-	-	±	c
<i>Poeltidea</i>	+	± bl	-	-	-	-	c
<i>Koerberiella</i> *	+	± blbr	-	-	- 2)	+	(?)
<i>Xenolecia</i> *	+	± bl	-	-	-	±	f
<i>Paraporpidia</i>	-	± bl/orr	+/-	-	-	+	f
<i>Stephanocyclos</i> *	+	+ bl	-	-	-	+	f
<i>Poeltiaria</i>	±	± bl	+/-	-	+/-	-	f(c)
<i>Notolecidea</i> *	+	+ bl	-	-	-	-	c
<i>Stenhammarella</i> *	+	+ bl	-	-	-	+	f
<i>Porpidia</i>	+	+ bl	+/-	-	-	+	c
<i>Farnoldia</i> *	+	+ bl	+/-	-	+/-	+	c

Table 13b. The main characteristics of the genera of the Porpidiaceae:
 1.) development of an epinecral layer; 2.) development of psoroid growth forms 3.) development of a proper margin; 4.) adnation of apothecia; 5.) development of a distinct hypothallus; 6.) type of substratum; 7.) chemistry
 [ca = calcareous; de = depsides; di = dibenzofurans; do = depsidones; i = immersed; n.s. = no lichen substances; s = siliceous; se = sessile; si = subimmersed; us = usnic acids; * = not reported from Australia].

2) apothecia with "lecanorine" margination

3) sessile on the thallus, immersed into the substratum in some cryptothalline species

	Epinecr. layer	Apoth. marg.	Apoth. adn.	Hyp.th.	Substratum	Chemistry
<i>Clauzadea</i> *	-	+/-	se/i ³⁾	-	ca	n.s.
<i>Schizodiscus</i> *	-	±	si/i	+	s	de
<i>Amygdalaria</i> *	-	±	se/i	- ?	s	de,do
<i>Bellemerea</i>	+/-	-	i	+	s/ca	de,do
<i>Immersaria</i>	+	±	i	+	s/ca	de,do
<i>Poeltidea</i>	+	±	i	+	s	n.s.
<i>Koerberiella</i> *	-	- 2)	i 2)	+/-	s	de (?)
<i>Xenolecia</i> *	-	-	i	-	s	de
<i>Paraporpidia</i>	-	+	se	+/-	s	de
<i>Stephanocyclos</i> *	-	+	se	+	s	de
<i>Poeltiaria</i>	-	+	se	- ?	s	de,di,us
<i>Notolecidea</i> *	-	+	se	+	s	n.s.
<i>Stenhammarella</i> *	-	±	si/i	+	ca	n.s.
<i>Porpidia</i>	-	+	se/si	+/-	s/ca	de,di,do
<i>Farnoldia</i> *	-	+	se	+/-	ca	n.s.

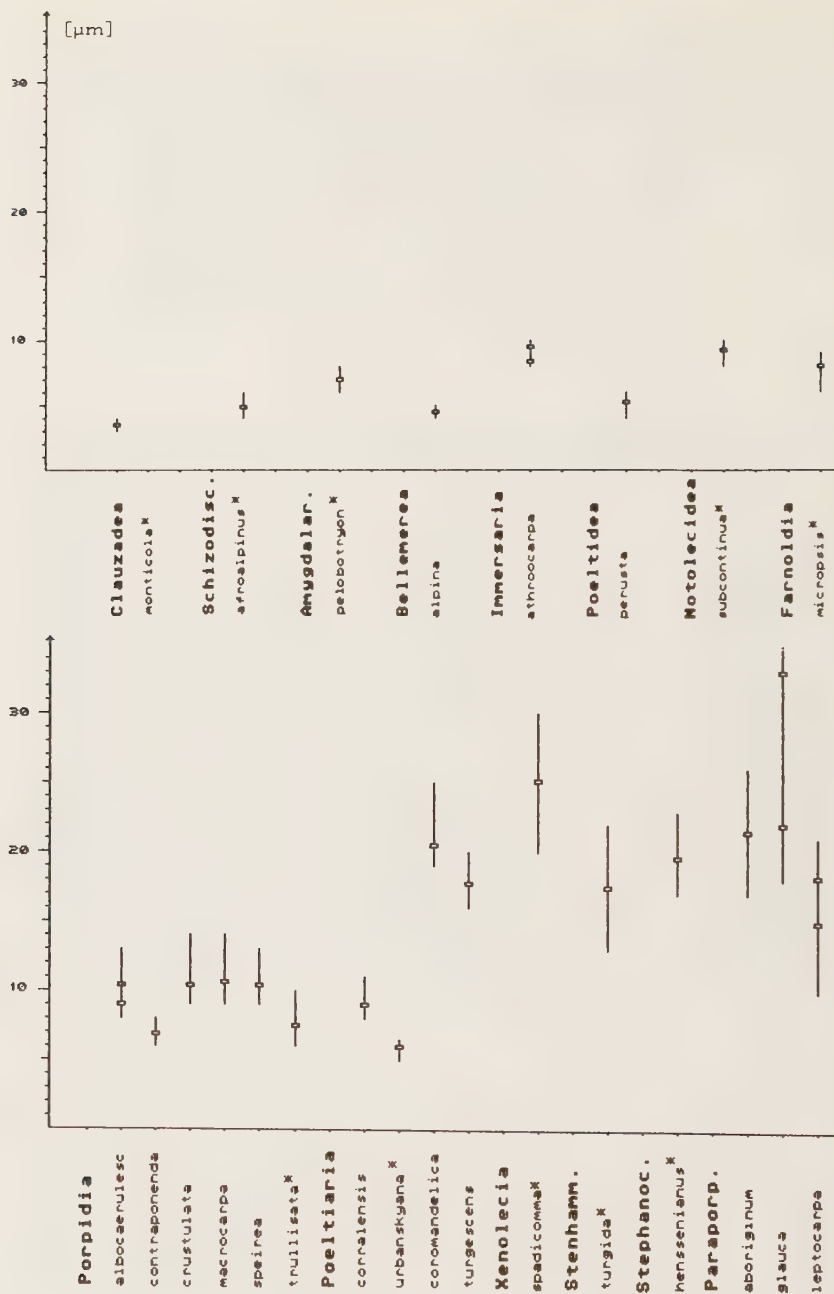


Fig. 23. Length of conidiospores in genera of the Porpidiaceae
[* not reported from Australia]

***Immersaria* Rambold & Pietschmann gen. nov.**

Typus generis: *I. athroocarpa* (Ach.) Rambold & Pietschmann

DIAGNOSIS:

Genus Porpidiacearum (Ascomycetes lichenisati). Thallus crustaceus. Apothecia atra vel grisea, immersa, plus minusque marginata, non umbonata. Hypothecium incoloratum usque ad fuscum. Sporae incoloratae et halonatae. Conidia cylindrica. Saxicola, in hemispherico septentrionali et meridionali vigens.

This genus of the Porpidiaceae comprises hitherto one species, which recently was placed in the genera *Amygdalaria* and *Porpidia*. It shows immersed apothecia, halonate spores and contains, similar to most members of *Porpidia* and *Amygdalaria*, para-depsides and the β -orcinol depsidones.

The generic position of *I. athroocarpa* has recently been discussed controversially by several authors. Disregarding the tholus structure, INOUE (1982: 23) assumed that this species was related to *Lecidea instratula* [= *Clauzadeana macula*], to *Lecidea atrobrunnea* or to *Lecidea perusta* Nyl. [= *Poeltidea perusta*]. CLAUZADE & ROUX (1985: 157) assigned *L. athroocarpa* to *Amygdalaria*. HERTEL & RAMBOLD (1985) also transferred this species to the Porpidiaceae. However, they included it into *Porpidia*, which was already regarded to be heterogenous. ESNAULT & ROUX (1987) affirmed the relationship to *Amygdalaria*, using the reduction of the excipulum and the brown pigmentation of the cortical layer as arguments for its exclusion from *Porpidia*. A strongly reduced excipulum (amphithegium), along with a brown pigmented thallus cortex, however, occurs also in *Bellemerea* (e.g. in *B. cupreoatra* (Nyl.) Clauz. & Roux) or in *Poeltidea* (with *P. perusta*) aside from *Amygdalaria*. In *Amygdalaria* s.str., on the other hand, there are no species with a nitid brown thallus, but there are also species with well developed excipula and sessile apothecia, e.g. *A. aeolotera* (Vain.) Hertel & Brodo or *A. elegantior* (H. Magn.) Hertel & Brodo (BRODO & HERTEL 1987).

The two monotypic genera *Schizodiscus* Brusse (*Sch. afroalpinus* Brusse) with non-halonate spores, and *Koerberiella* Stein (*K. wimmeriana* (Koerb.) Stein) with large halonate spores, and the aspicilioid genus *Bellemerea* Hafellner & Roux, comprising aspicilioid species with halonate spores with amyloid walls, probably are closely related to *Immersaria*. The main similarities and differences between *Immersaria* and other genera of the Porpidiaceae are given in table 13a, b.

***Immersaria athroocarpa* (Ach.) Rambold & Pietschmann comb. nov.**

- = *Lichen athroocarpus* Ach. ("*L. athrocarpus*"), Lich. Suec. Prodrum.: 77 (1798).
- = *Lecidea athroocarpa* (Ach.) Ach., Method. Lich.: 41 - 42 (1803); ZAHLBRÜCKNER, Catal. Lich. Univ. 3: 521 - 522 no. 6302 (1925); 8: 332 (1932); HERTEL, Herzogia 1: 417 (1970); Khumbu Himal 6 (3): 228 - 230 (1977); HERTEL & ZHAO, Lichenologist 14: 146 (1982); INOUE, J. Sci. Hiroshima Univ., Ser. B, Div. 2, Bot. 18: 22 - 25 (1982); SANTESSON, Lich. Sweden Norway: 159 (1984).
- = *Lecidea fuscoatra* var. *athroocarpa* (Ach.) Boist., Nouv. Flore Lich. 2: 217 (1903) [n.v.].
- = *Porpidia athroocarpa* (Ach.) Hertel & Rambold in Hertel, Lecideac. Exs. fasc. VIII: 8 no. 156 (1985); HERTEL, Mitt. Bot. Staatssamml. München 21: 312 - 313 (1985); BRODO & HERTEL, Herzogia 7: 497 (1987).
- = *Amygdalaria athroocarpa* (Ach.) Clauz. & Roux, Bull. Soc. Bot. Centre-Ouest, N.S., Numéro Spécial 7: 157 (1985) [comb. inval.: ICBN art. 33.2.]; ESNAULT & ROUX, Anal. Jard. Bot. Madrid 44 (2): 211 - 225 (1987).
- Type: SWEDEN: [no locality, no date, no collector] (H-Ach, lectotype - designated in HERTEL 1977).
- = *Porpidia afromontana* Brusse **syn. nov.**
BRUSSE, Bothalia 18 (1): 93 - 94 (1988).
Type: SOUTH AFRICA: Cape, 3028 (Matatiele): 65 km N of Maclear, summit of Naudé's Nek, on basalt rocks on summit plateau, in full sun, 2500 m, 26.i.1986, leg. F. Brusse (PRE!, holotype, BM!, isotype).

DESCRIPTION:

Thallus: areolate, up to 100 mm diam., 0.1 - 0.7 mm thick.

AREOLES: more or less angular, brown, plane to concave, with smooth surface, c. 0.5 - 0.7 mm, max. 0.8 - 1.2 mm diam. Cortex 20 - 50 µm thick; upper cell layer brown to pale brown pigmented; hyphae c. 3 - 4.5 µm diam.; epinecral layer 35 - 95 µm thick. Algal layer c. 65 - 120 µm thick; algal cells c. 9 - 11 µm, max. 13 - 15 µm diam. Medulla I+ violet; hyphae 3.5 - 7 µm thick.

HYPOTHALLUS: black to grey, obvious between the areoles and at the thallus margin.

Apothecia: roundish to angular, dispersed to crowded, 20 - 120/cm², immersed, c. 0.6 - 0.8 mm, max. 0.7 - 1.3 mm diam. Disc plane to concave, dark grey to black, matt, pruinose or not. Margin at first usually not distinct, later vanishing, grey or black, matt.

EXCIPULUM: max. 15 - 30 µm, lateral of hymenium 15 - 30 µm thick or completely reduced. Ectal zone dark brown to grey; pigmented zone 8 - 15 µm tall; hyphae 3 - 4 (- 5) µm diam., with lumina of 1 - 1.5 µm. Inner zone colourless to brownish; hyphae 3 - 4 µm diam., with lumina of c. 1 µm. Medullary zone more or less distinct.

HYPOTHECIUM: dark to pale brownish or nearly colourless, up to

200 µm thick; hyphae 3 - 4 µm diam.; subhymenial layer colourless to brown, 30 - 120 µm thick.

HYMENIUM: 85 - 125 µm tall, colourless, I+ yellow to bluish, Iconc. ± orange-red. Epihymenium black-brown to green-brown, 10 - 20 µm tall. Paraphyses branched and anastomosing, 1.5 - 2 µm, apices 2.5 - 4 µm thick. Asci c. 85 - 100 x 15 - 26 µm; tholus max. 20 - 27 µm, min. 6 - 16 µm thick; amyloid tube c. 7 - 9 µm broad; outer amyloid wall layer 1 µm thick, I+ red-brown, Iconc.+ red; non-amyloid wall layer 0.3 µm thick. Spores ellipsoid, 13 - 19.5 x 7 - 9.5 µm [fide HERTEL (1977: 229): 13 - 23 x 6 - 12 µm].

Pycnidia: immersed. Conidia cylindrical, 6 - 9 (- 12) x 1 - 1.2 (- 1.5) µm.

CHEMISTRY: Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

Three chemotypes observed:

- a) containing confluent acid (major), 2'-O-methylmicrophyllinic acid (minor), 2'-O-methylperlatolic acid (trace or not) (10 specimens examined);
- b) containing additional norstictic acid (1 specimen examined);
- c) containing 2'-O-methylperlatolic acid (major), confluent acid (trace or not) (9 specimens examined).

DISTRIBUTION:

Bipolar. New to Australia! In the Northern Hemisphere, this species is known from Europe and Asia (HERTEL 1977: 229). In the Southern Hemisphere it has been reported from New Zealand (South Island) by HERTEL (1985: 312 - 313) and was recently described from South Africa as *Porpidia afromontana* by BRUSSE (1988a). Within continental Australia (N.S.W., A.C.T., Vic.), *I. athroocarpa* is common in the (sub-)alpine zone (map 46), growing on exposed, siliceous rock.

NOTES:

I. athroocarpa is characterized by constantly immersed, black apothecia and nitid brown areoles with a more or less concave surface and a rather thick epinecral layer. The species is very variable concerning the pigmentation of the hypothecium. The three chemical strains found in European material by ESNAULT & ROUX (1987), also occur in Australia.

SPECIMENS EXAMINED:

New South Wales: Lithgow [33°29'S, 150°10'E], ix.1897, [conf1.], leg. F. R.M. Wilson (NSW 155824); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, [conf1.], leg. G.Rambold 3750 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, [conf1.], leg. G.Rambold 3635, [conf1.], 3637, (M); -- Kosciusko National Park, 0.5 km WNW of Charlottes Pass, 36°26'S, 148°19'E, granitic boulders beside Snowy River near track to Blue Lake,



Map 46. Distribution of *Immersaria athrocarpa* in continental Australia

1720 m, 14.i.1986, [2'-O-mpa], leg. G.Rambold 3465, [2'-O-mpa], 3471 (M), [confl.], 3466 (M, NSW); -- Kosciusko National Park, Muellers Pass, 2.5 km NNE of Mt Kosciusko, 36°26'S, 148°16'E, N exposed vertical and overhanging rock wall beside track, 2000 m, 17.i.1986, [2'-O-mpa], leg. G.Rambold 3589 (M, NSW); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, [confl.], leg. G.Rambold 3548 (M); -- Kosciusko National Park, Mt Kosciusko, 36°27'S, 148°16'E, boulders on exposed summit, 1980 m, 17.i.1986, [2'-O-mpa], leg. G. Rambold 3553 (M), 3558 (M, NSW); -- Valentine River, Junction directly below Grey Mare Hut, 5000 ft, 16.iii.1967, [2'-O-mpa], leg. R.Filson 10154 (MEL).

A.C.T.: Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, [confl.], leg. G.Rambold 4007; -- [2'-O-mpa], 4057 (M); -- 21.i.1984, [confl.], leg. P.W.James (BM); -- Booroomba Rocks, 11 km SW of Tharwa, [35°35'S, 149°00'E], 1360 m, 11.vii.1979, [confl.], leg. J.A.Elix 6133 (ANUC); -- Mt Clear, Clear Range, 64 km S of Canberra, 35°53'S, 158°05'E, 1590 m, 1.x.1980, leg. H.Streimann 10586 (CBG).

Victoria: Bogong Highplains, along the Longford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S,

147°18'E, c. 1600 m, 26.ii.1985, [2'-O-mpa], leg. H.Hertel 31450 (M); -- Great Dividing Range, Mt Woombargo near Rocky Plains, rock flow, 36°56'S, 148°12'E, c. 1400 m, 27.ii.1985, [2'-O-mpa], leg. H.Hertel 31525 (M); -- Summit of Mt Sterling, 12.ii.1967, [confl.], leg. R.Filson 9698 (MEL).

***Paraporpidia* Rambold & Pietschmann gen. nov.**

Typus generis: *P. aboriginum* Rambold

DIAGNOSIS:

Genus *Porpidiacearum* (*Ascomycetes lichenisati*). *Thallus crustaceus*. *Apothecia mediocria vel magna, atra vel grisea, sessilia vel immersa, marginata, non umbonata*. *Hypothecium fuscum*. *Sporae incoloratae et non halonatae*. *Conidia filiformia*. *Saxicola, restricta regione austral-asiatica et asiatica*.

This new genus in the Porpidiaceae comprises species, which are characterized by non-halonate spores, filiform conidia, a dark pigmented hypothecium and non-gyrodisc apothecia. Two species (*P. aboriginum* and *P. glauca*) are well adapted to arid climates and are Australian endemics, while a third species (*P. leptocarpa*) occurs in less arid regions of Australasia (Australia, New Zealand and New Caledonia) and is also known from Asia (China and Java). The most closely related genus probably is *Poeltiaria* with species having either cylindrical or filiform conidia. The most important distinguishing characters of the latter genus are the more or less unpigmented hypothecium and mostly halonate spores. The recently described genus *Schizodiscus* Brusse, with *Sch. afroalpinus* Brusse as only species, also has non-halonate spores and asci with a tube-like amyloid structure. The conidia however are shortly cylindrical (only 4 - 6 µm long), while in *Paraporpidia* they are filiform, ranging in length from 10 µm to more than 30 µm (fig. 23). BRUSSE (1988b) compared *Schizodiscus* with *Clauzadea* Hafellner & Bellemère, which also comprises species with short conidia and poorly halonate spores, but shows a different type of paraphyses and is restricted to calcareous substrata.

***Paraporpidia aboriginum* Rambold sp. nov.**

DIAGNOSIS:

Similis P. glaucae, sed solum acidum 2'-O-methylmicrophyllinicum continens. Ad saxam et terram sabulosam crescens, restricta centro Australiae continentalis.

Type: Macdonnell Ranges, Pine Valley, c. 18 km SW of Alice Springs, 23°49'S, 133°46'E, on soil and low boulders, c. 600 m, 19.iii.1986, leg. G.Rambold 5075 (M!, holotype).

DESCRIPTION:

Thallus: verrucose, rimose to areolate, up to 60 mm diam., 0.1 - 0.5 mm thick.

AREOLES: irregular to angular, pale white-green, plane to subconvex, with rough to smooth surface, c. 0.7 - 1.0 mm, max. 1.0 - 1.6 mm diam. Cortex 10 - 25 µm thick; upper cell layer not pigmented; hyphae c. 2 - 3 µm diam.; epinecral layer 12 - 15 µm thick. Algal layer c. 40 - 80 µm thick; algal cells c. 8 - 9 µm, max. 10 - 12 µm diam. Medulla I-; hyphae 2.8 - 3 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish to auriculate, dispersed, 4 - 15/cm², sessile, not constricted at the base, c. 1.0 - 1.4 mm, max. 1.2 - 3 mm diam. Disc plane to subconvex, grey to light greyish, matt, pruinose. Margin at first obvious or not, later more or less persistent, grey to white, matt.

EXCIPULUM: max. 55 - 70 µm, lateral of hymenium 45 - 55 µm thick. Ectal zone dark brown; hyphae 3 - 3.5 µm diam., with lumina of 1 - 1.3 µm. Inner zone dark brown; hyphae 4.5 - 5 µm diam., with lumina of 1 - 3 µm. Medullary zone not obvious.

HYPOTHECIUM: dark brown, 250 - 550 µm thick; hyphae 3 - 4 µm diam.; subhymenial layer colourless, 10 - 25 µm thick.

HYMENIUM: 50 - 65 µm tall, colourless, I± blue, Iconc.± orange-red. Epihymenium brown, c. 12 µm tall. Paraphyses branched and anastomosing, 2 - 2.5 µm, apices 2.5 - 3 µm thick. Asci c. 50 - 65 x 10 - 11 µm; tholus max. 9 - 13 µm, min. 5 - 8 µm thick; outer amyloid wall layer 0.5 - 0.8 µm thick, I+ brown, Iconc.+ orange-red; non-amyloid wall layer c. 0.5 µm thick. Spores ellipsoid, 10 - 13 x 4.5 - 6 µm.

Pycnidia: immersed. Conidia filiform, c. 17 - 21 - 26 x 0.8 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing 2'-O-methylmicrophyllinic acid (8 examined specimens).

DISTRIBUTION:

Endemic. *P. aboriginum* is the only saxicolous lecideoid species, restricted to central Australia (map 47). It grows on low siliceous boulders or on soil between rock in sheltered position with a southern aspect.

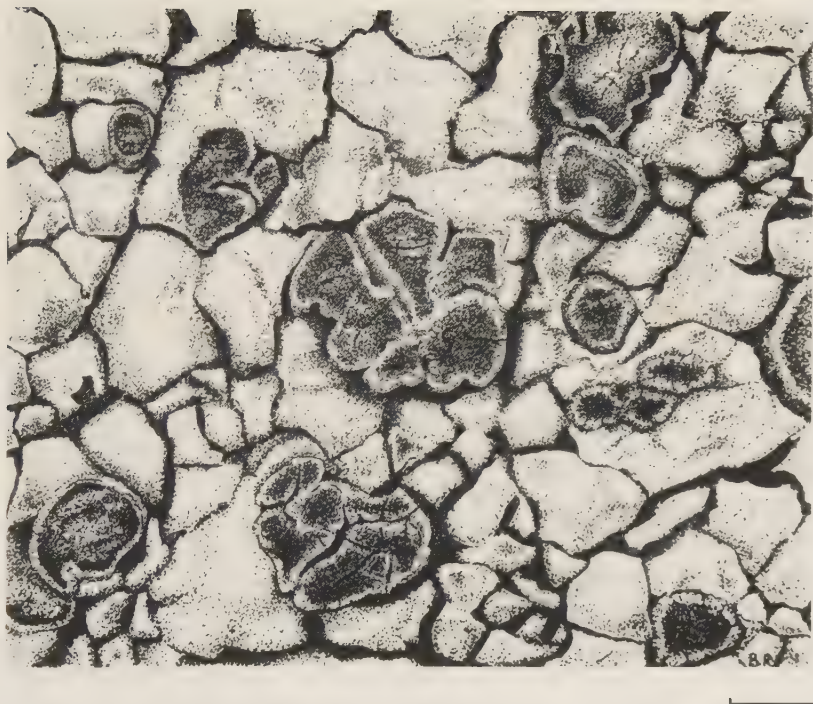


Fig. 24. *Paraporphidia aboriginum*. (JAE 11198, ANUC) Scale = 1 mm.

NOTES:

P. aboriginum is closely related to *P. glauca*. The latter is distinguished by its much wider distribution, by its chemistry and an $\pm$ amyloid medulla. Aside from *P. aboriginum*, the occurrence of 2'-O-methylmicrophyllinic acid as major substance has hitherto only been observed among lecideoid lichens in *Lecidea fuscoatrula*. The specific epithet refers to the Australian aborigines.

SPECIMENS EXAMINED:

Northern Territory: Forster Range, ridge 20 km S of Barrow Creek, 21°38'S, 133°44'E, 610 m, 13.ix.1983, leg. J.A.Elix 11197, 11198 (ANUC); -- 25 km SW Alice Springs, 23°49'S, 133°47'E, 24.ii.1976, leg. P.K.Latz 6378 (NT, MEL); -- Macdonnell Ranges, Pine Valley, c. 18 km SW of Alice Springs, 23°49'S, 133°46'E, on soil and low boulders, c. 600 m, 19.iii.1986, leg. G.Rambold 5061, 5062, 5065, 5066, 5069, 5071, 5072, 5075 (M); -- Bagot Spring, [23°57'S, 132°38'E], 3.ix.1967, leg. H.A.Morrison (MEL 1026818); -- James Range, 88 km S of Alice Springs along Stuart Hwy, 24°19'S, 133°28'E, 470 m, 11.ix.1983, leg. J.A.Elix 11130 (ANUC).



Map 47. Distribution of *Paraporpidea aboriginum* in continental Australia

***Paraporpidea glauca* (Th.Tayl.) Rambold comb. nov.**

≡ *Lecidea glauca* Th.Tayl. in Hooker, London Journ. Bot. 6: 149 (1847); ZAHLBRÜCKNER, Catal. Lich. Univ. 3: 876 no. 7379 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 47 (1983); Checklist Austr. Lich. 2. ed.: 60 (1986); Austr. Fl. Fauna Ser. 4: 118 (1986); Checklist Austr. Lich. 3. ed.: 19, 103 (1988).

≡ *Psora glauca* (Th.Tayl.) Müll.Arg., Flora 71: 538 (1888).

≡ *Tremolecia glauca* (Th.Tayl.) Hertel & Schneider in Schneider, Biblioth. Lich. 13: 240, 255 (1980).

Type: AUSTRALIA: Western Australia: Swan River, 1843, leg. J. Drummond (FH!, lectotype; BM!, E!, FH!, isolectotypes - designated in SCHNEIDER 1980) - [containing 2'-O-methylperlatolic acid].

= *Psora psammophila* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Hedwigia 31: 194 - 195 (1892); FILSON, Austr. Fl. Fauna Ser. 4: 249 (1986).

= *Lecidea psammophila* (Müll.Arg.) Zahlbr., Catal. Lich. Univ. 3: 889 no. 7426 (1925); FILSON & ROGERS, Lich. South Austr.: 97 (1979); SCHNEIDER, Biblioth. Lich. 13: 240 (1980); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); Checklist Austr. Lich. 2. ed.: 63 (1986); Checklist Austr. Lich. 3. ed.: 106 (1988).

Type: AUSTRALIA: South Australia: Camp 10, 14 mi W of Turner Hill, 28.v.1891, leg. R.Helms 24 (G!, holotype; MEL!, isotype) - [containing 2'-O-methylperlatolic acid (major), 2'-O-methyl-microphyllinic acid (minor)].

DESCRIPTION:

Thallus: verrucose to rimose, up to 50 mm diam., c. 0.1 mm thick.

AREOLES: irregular, whitish to greenish, plane, with rough surface, c. 0.5 - 1.0 mm, max. 1.0 - 1.7 mm diam. Cortex 0 - 10 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer 7 - 15 µm thick. Algal layer c. 40 - 70 µm thick; algal cells c. 8 µm, max. c. 9 - 10 µm diam. Medulla I ± violet; hyphae 2 - 2.5 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: roundish to irregular, dispersed to crowded, 15 - 50/cm², sessile, mostly not constricted at the base, c. 0.8 - 1.4 mm, max. 1.5 - 2.0 mm diam. Disc convex, grey, matt, pruinose. Margin at first distinct, mostly persistent, black to grey, matt.

EXCIPULUM: max. 60 - 150 µm, lateral of hymenium 60 - 100 µm thick. Ectal zone dirty brown; pigmented zone 12 - 20 µm tall; hyphae 3 - 4.5 µm diam., with lumina of 1 - 1.5 µm. Inner zone colourless to pale grey-brown; hyphae 3 - 5 µm diam., with lumina of (1 -) 1.5 - 2 (- 4) µm. Medullary zone more or less developed.

HYPOTHECIUM: brown to dark brown, 100 - 200 µm thick; hyphae (2 -) 3 µm diam.; subhymenial layer colourless to pale brown, (10 -) 20 - 35 µm thick.

HYMENIUM: 60 - 80 (- 100) µm tall, colourless, I ± blue, Iconc. ± red. Epihymenium brown, diffuse. Paraphyses branched and anastomosing, 1.5 - 2 µm, apices 2.5 - 3.5 µm thick. Asci c. 55 - 70 x 10 - 12 µm; tholus max. c. 10 µm, min. 5 - 7 µm thick; amyloid tube c. 3 - 3.5 µm broad; outer amyloid wall layer c. 0.8 - 1.0 µm thick, I+ brown, Iconc.+ orange-red; non-amyloid wall layer c. 0.5 µm thick. Spores ellipsoid, 10 - 16 x 4.5 - 7.5 µm.

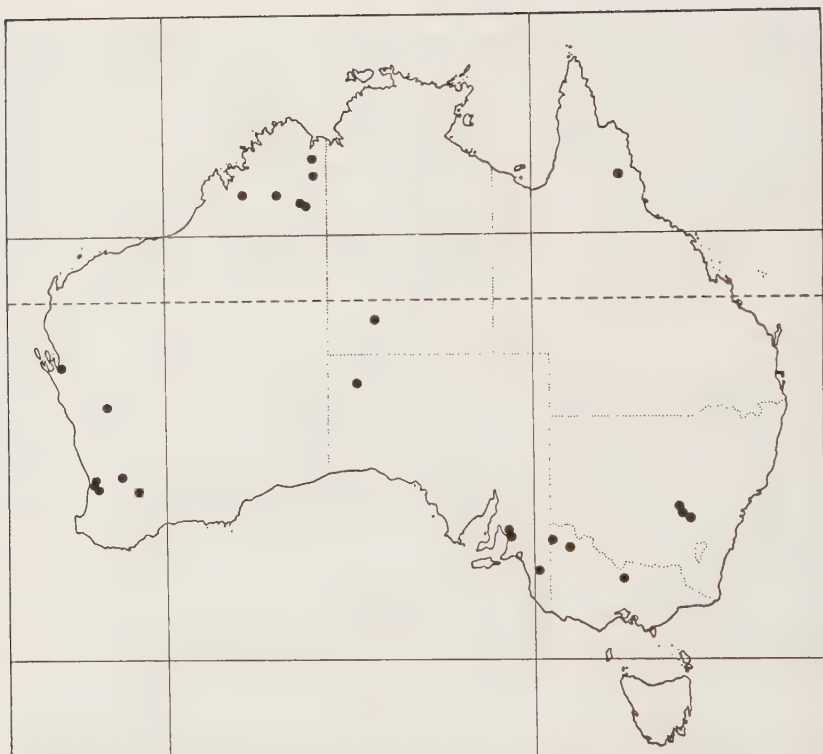
Pycnidia: immersed. Conidia filiform, 18 - 22 - 33 - 38 x 0.8 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

Two chemotypes observed:

- a) containing confluent acid (major), 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid (minor) (15 specimens examined);
- b) containing 2'-O-methylperlatolic acid (23 specimens examined).



Map 48. Distribution of *Paraporpidia glauca* in continental Australia

DISTRIBUTION:

Endemic (?). *P. glauca* occurs in semi-arid to arid regions all over continental Australia, growing on soil and on siliceous boulders. It has been collected in W.A., S.A., N.T., Qld, N.S.W. and Vic. (map 48).

NOTES:

The species is quite variable in the amyloid reaction of the medulla. It is represented by the same two main chemotypes as *P. leptocarpa*, which differs in constantly having a non-amyloid medulla, a I + bluish or I - hymenium and a blackish-brown inner zone of the excipulum. Both species are also distinguished ecologically, showing very different distribution patterns. *Porpidia speirea* is similar to *Paraporpidia glauca* in that it contains confluent acid and shows an amyloid medulla, however, it grows in the alpine zone and has - like all other species of *Porpidia* s.str. - a Iconc. + blue hymenium and cylindrical conidia.

SPECIMENS EXAMINED:

Western Australia: Mt Cockburn South, Cockburn Range, 45 km S of Wyndham, 15°55'S, 128°09'E, 300 m, 21.v.1988, [2'-O-mpa], leg. J.A.Elix 22442 (ANUC); -- Erskine Range, Great Northern Hwy, between Derby and Fitzroy Crossing, 17°51'S, 124°20'E, 120 m, 18.v.1988, [2'-O-mpa], leg. J.A.Elix 22331 (ANUC); -- Great Northern Hwy, 25 km E of Christmas Hills Station, between Halls Creek and Fitzroy Crossing, 17°54'S, 126°10'E, 250 m, 18.v.1988, [2'-O-mpa], leg. J.A.Elix 22340, 22342, 22354 (ANUC); -- Mt Nyulasy, Great Northern Hwy, 25 km E of Christmas Hills Station, between Halls Creek and Fitzroy Crossing, 17°54'S, 126°10'E, 250 m, 18.v.1988, [2'-O-mpa], leg. J.A.Elix 22341 (ANUC); -- Great Northern Hwy, 26 km SW of Halls Creek 18°22'S, 127°29'E, 400 m, 10.v.1988, [2'-O-mpa], leg. J.A.Elix 22124 (ANUC); -- Sawpit Gorge, Black Elvire River, Albert Edward Range, 27 km SE of Halls Creek 18°26'S, 127°49'E, 340 m, 19.v.1988, [2'-O-mpa], leg. J.A.Elix 22368 (ANUC); -- 103 mi SSE of Canarvon, NW Coast Hwy, [26°30'S, 114°20'E], 21.viii.1965, [confl.], leg. A.C.Beaglehole 14074 (MEL); -- Geraldton to Mt Magnet road, 2 mi E of Yalgoo, [28°21'S, 116°45'E], 20.ix.1966, [2'-O-mpa], leg. R.Filson 8953 (MEL 18221); -- Great Eastern Hwy, 5 km E of Tammin, 31°38'S, 117°31'E, 19.vii.1973, [2'-O-mpa], leg. R.W.Rogers 1020 (BRIU); -- John Forrest National Park, NE of Perth, 31°44'S, 116°05'E, low conglomerate boulders in sclerophyll forest, 3.iv.1986, [2'-O-mpa], leg. G.Rambold 5439, [2'-O-mpa], 5436, [confl.], 5434 (M); -- "Swan River", [31°45'S, 116°04'E], 1843, [2'-O-mpa], leg. J.Drummond (type of *Lecidea glauca* Tayl., BM ex K, E, G); -- John Forrest National Park, 25 km E of Perth, [31°52'S, 116°05'E], 11.viii.1973, [2'-O-mpa], leg. N.Sammy 830682 (PERTH); -- John Forrest National Park, 26 km E of Perth, [31°52'S, 116°05'E], 20.x.1982, [confl.], leg. J.A.Elix 10493 (ANUC); -- John Forrest National Park, [31°52'S, 116°05'E], iii.1930, [confl.], leg. M.Johnson (MEL 7240); -- Armadale Hills, [32°09'S, 116°00'E], 45 m, iv.1976, [2'-O-mpa], leg. J.A.Elix 2693 (ANUC); -- Mt Cooke, 42.5 mi SSE of Perth, [32°25'S, 116°18'E], 3.iii.1974, [confl.], leg. N.Sammy 820428 (PERTH); -- Kondinin Forestry Reserve, [32°30'S, 118°24'E], 9.x.1967, [confl.], leg. G.C.Bratt 67/375 (HO); -- Kondinin Forestry Reserve, near Kondinin, [32°30'S, 148°16'E], 1000 ft, 9.x.1967, [confl.], leg. G.C.Bratt & R.C.Weeks RWR 1735 (BRIU); -- 80 km S of Perth, Sullivan Rock, 2.ix.1987, [confl.], leg. H.T.Lumsch 5569 b (hb. Lumsch); 21 km E of Nornalup, 30 m, 26.x.1982, [2'-O-mpa], leg. J.A.Elix 10691 (ANUC).

Northern Territory: George Gill Range, Carmichael Crag, 24°13'S, 131°33'E, 9.vii.1968, [2'-O-mpa], leg. A.C.Beaglehole 26407 (MEL).

South Australia: Camp 10, 14 mi W of Turner Hill, [27°20'S, 130°30'E], 28.v.1891, [2'-O-mpa], leg. R.Helms (type of *Psora psammophila* Müll. Arg.) (G, MEL 7147); -- Ferguson Park, Burnside, 34°25'S, 138°41'E, 7.i.1970, [confl.], leg. R.W.Rogers 1845 (MEL), 1845 (BRIU); -- Southern Lofty Region, near Barossa Reservoir, Williamstown, 34°40'S, 138°53'E, 29.x.1968, [confl.], leg. R.W.Rogers 1479 (AD); -- Mt Monster Conservation Park, 12 km S of Keith on Dukes Hwy, 36°12'S, 140°19'E, 15.viii.1981, [2'-O-mpa], leg. M.& H. Mayrhofer 2827 (GZU).

Queensland: Mt Mulligan, 16°52'S, 144°52'E, E facing scree slope below sheer cliffs, on conglomerate sandstone boulders and on soil, 450 m, 5.iii.1986, [2'-O-mpa], leg. G.Rambold 4958, 4961, 4962, 4963 (M), 4959, 4960 (M, BRI).

New South Wales: Near old Railway Company Dam, Grenfell, [33°23'S, 148°02'E], 16.vii.1978, [2'-O-mpa], leg. J.A.Elix 4842 (ANUC); -- Warranderry Range, Warranderry State Forest, 23 km N of Grenfell, 33°41'S, 148°12'E, 380 m, 12.x.1984, [2'-O-mpa], leg. H.Streimann 31497 (CANB, H, M, US); -- [2'-O-mpa], 31498 (CBG, H, M, US), [2'-O-mpa], 31515 (CBG); -- Warranderry Range, Warranderry State Forest, 23 km N of Grenfell, 33°41'S, 148°12'E, 380 m, 17.x.1984, [2'-O-mpa], leg. J.A.Elix 17714 (ANUC); -- 4 km E of Koorawatha, [34°02'S, 148°37'E], 365 m, 10.ix.1980, [confl.], leg. J.A.Elix 8881 (ANUC).

Victoria: Rock Ridge, 1 mi NW of Rock Holes, 29 mi N of Carina, 6 mi W of Murrayville, [34°50'S, 141°05'E], 16.xi.1971, [confl.], leg. R.Filson

14291 (MEL); -- 30 km W of Ouyen along Hwy 12, [35°08'S, 142°00'E], 28.viii.1977, [confl.], leg. J.A.Elix 3689 (ANUC, MEL); -- Gawlers Hill, Rushworth, [36°35'S, 145°01'E], 1.x.1948, [confl.], leg. P.N.S.Bibby (MEL 1018488).

***Paraporphidia leptocarpa* (Bab. & Mitt.) Rambold & Hertel comb. nov.**

= *Lecidea leptocarpa* Nyl. nomen nudum!, Enum. Gen. Lich.: 125 (1857) [Mem. Soc. Sci. Nat. Cherbourg 5: 125 (1859)].

= *Lecidea leptocarpa* Nyl. ex Bab. & Mitt. in Hooker, Fl. Tasmaniae 2: 352, tab. CC, fig. C (1859) - (according to ICBN art. 44, the drawings can be regarded as an original description!); MÜLLER, Fragm. Phytogeogr. Austr. 11: 117 (1880); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 615 no. 6525 (1925); WETMORE, Rev. Bryol. Lichenol. 32: 241 (1963); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); HERTEL, Beih. Nova Hedwigia 79: 464 - 465 (1984); GALLOWAY, Fl. New Zeal. Lich.: 234 - 235 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 122 (1986); Checklist Austr. Lich. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: Tasmania: St. Patrick's River, [no date], leg. Gunn [according to BABINGTON & MITTEN in HOOKER 1859: 352], (BM!, holotype; H-Nyl. 15.332, fragmentulum typi) - [containing confluent acid, 2'-O-methylperlatolic acid, 2'-O-methylmichophyllinic acid].

?= *Lecidea enterophaea* Knight

KNIGHT, Trans. Linn. Soc. London, Bot., ser. 2, 2: 46 tab. VIII, fig. 27 (1882); WILSON, Proc. Roy. Soc. Queensl. 6 (2+3): 92 (1885); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 756 no. 7000 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 115 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).

Type: AUSTRALIA: New South Wales: [neighbourhood of Sydney], (WELT, vol. 204. p. 27, no. 27 - drawing only!).

= *Lecidea microspora* Knight nomen illegit.!,

Trans. Linn. Soc. London, Bot., ser. 2, 2: 47, tab. X, fig. 33 (1882) non *Lecidea microspora* Nyl. 1856; WILSON, Proc. Roy. Soc. Queensl. 6: (2+3): 92 (1885); FILSON, Austr. Fl. Fauna Ser. 4: 124 (1986); Checklist Austr. Lich. 3. ed.: 104 (1988).

= *Lecidea knightiana* Zahlbr., Catal. Lich. Univ. 3: 604 no. 6504 (1925). [nomen novum pro *Lecidea microspora* Knight!]; WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); HERTEL, Beih. Nova Hedwigia 79: 466 (1984); FILSON, Austr. Fl. Fauna Ser. 4: 121 (1986).

Type: AUSTRALIA: New South Wales, [neighbourhood of Sydney - vide KNIGHT 1882: 37], [no date], leg. Ch.Knight (WELT (vol. 200, p. 31), holotype; M!, isotype = lectotype fide HERTEL 1984) - [containing confluent acid (major), 2'-O-methylperlatolic acid (traces)].

= *Lecidea subpromiscua* Nyl. **syn. nov.**

NYLANDER, Flora 69: 325 (1886); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 702 no. 6784 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 50 (1983); HERTEL, Beih. Nova Hedwigia 79: 466 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 64 (1986); Austr. Fl. Fauna Ser. 4: 130 (1986); Checklist Austr. Lich. 3. ed.: 20, 106 (1988).

Type: AUSTRALIA: New South Wales: [neighbourhood of Sydney - vide KNIGHT 1882: 37], 1880, leg. Ch.Knight (H-Nyl. 16851!, lectotype - designated in HERTEL 1984; H-Nyl 2451 isotype ?) - [containing 2'-O-methylperlatolic acid].

= *Lecidea ferax* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 1: 45 - 46 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 577 no. 6433 (1925); MAIDEN, Proc. Linn. Soc. New South Wales 23: 25 (1898); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); ELIX & STREIMANN, J. Hattori Bot. Lab. 51: 79 (1982); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 116 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).

Type: AUSTRALIA: Victoria: Lorne, [comm.] 1890, leg. F.R.M. Wilson 1026 (G!, holotype; NSW 155918, isotypes (?) [coll. 4.ii.1886]) - [containing confluent acid (major), 2'-O-methylperlatolic acid (minor), 2'-O-methylmicrophyllinic acid (traces)].

= *Lecidea ferax* var. *athallina* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 1: 46 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 577 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 116 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).

Type: AUSTRALIA: Victoria: Lorne, [comm.] 1890, leg. F.R.M. Wilson 1032 (G!, holotype; NSW 155924, isotype [coll. v.1887]) - [containing confluent acid (major), 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid].

= *Lecidea luehmanniana* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Hedwigia 32: 128 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 625 no. 6545 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 53 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 123 (1986); Checklist Austr. Lich. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: Victoria: Loutit Bay, leg. J.G.Luehmann (comm. F.v.Müller 1891) (G!, holotype; MEL!, isotype) - [containing confluent acid (major), 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid].

- = *Lecidea ferax* var. *geographica* Müll.Arg. **syn. nov.**
MÜLLER ARGОВIENSIS, Bull. Herb. Boissier 3: 641 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 578 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 52 (1972); ELIX & STREIMANN, Journ. Hattori Bot. Lab. 51: 79 (1982); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 59 (1986); Austr. Fl. Fauna Ser. 4: 117 (1986); Checklist Austr. Lich. 3. ed.: 19, 102 (1988).
Type: AUSTRALIA: Queensland: Thursday Island, [comm. (?)] 1887, leg. Ch. Knight 237 (G!, holotype) - [containing 2'-O-methylperlatolic acid; locality probably not correct].
- = *Lecidea ferricola* A.L.Smith **syn. nov.**
SMITH, J. Linn. Soc., Bot. 46: 75 (1922); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 874 no. 7375 (1925); SCHNEIDER, Biblioth. Lich. 13: 240 (1980).
Type: NEW CALEDONIA: [no locality, no date], leg. Compton 847 (BM!, isotype). "Mt Dore, 1000 ft, May" (vide protologue) - [containing confluent acid, 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid].
- = *Lecidea lividonigra* Zahlbr. in Handel-Mazzetti **syn. nov.**
HANDEL-MAZZETTI, Symbolae Sinicae 3: 98 (1930); ZAHLBRUCKNER, Catal. Lich. Univ. 8: 348 no. 14946 (1932).
- = *Tremolecia lividonigra* (Zahlbr.) Hertel, Khumbu Himal 6(3): 352-354 (1977).
Type: CHINA: Yünnan: In regione calide temperata prope urbem Yünnanfu ad rupes putridas prope templum Djindien-se, 2050 m, 16.ii.1914, leg. H.Handel-Mazzetti 108 (WU!, holotype) - [containing 2'-O-methylperlatolic acid].
- = *Lecidea tuberculans* Zahlbr. in Handel-Mazzetti **syn. nov.**
HANDEL-MAZZETTI, Symbolae Sinicae 3: 97 - 98 (1930); ZAHLBRUCKNER, Catal. Lich. Univ. 8: 362 no. 14970 (1932).
- = *Tremolecia tuberculans* (Zahlbr.) Hertel, Khumbu Himal 6(3): 357-358 (1977).
Type: CHINA: Yünnan: Prope vicum Hsinlung trans flumen Pudu-ho ad septentr. urbis Yünnanfu, 25°34'N, 2000 m, 10.iii.1914, leg. H.Handel-Mazzetti 1386 (WU!, holotype; W, isotype) - [containing 2'-O-methylperlatolic acid].
- = *Lecidea blastenoides* Zahlbr. **syn. nov.**
ZAHLBRUCKNER, Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. 104: 299 (1941) [reprints p. 51]; HERTEL, Beih. Nova Hedwigia 79: 463 - 464 (1984); GALLOWAY, Fl. New Zeal. Lich.: 224 - 225 (1985).
Type: NEW ZEALAND: South Island: Silver Peak near Dunedin, iii.1934, leg. J.S.Thomson (T 1164) ZA 267 (W!, holotype; BM, isotype) - [containing confluent acid (major), 2'-O-methylperlatolic acid (minor), 2'-O-methylmicrophyllinic acid].

= *Lecidea leptoplacoides* Räs.

RÄSÄNEN, Arch. Soc. Zool. Bot. Fenn. Vanamo 3: 183 (1949); LAMB, Index Nom. Lich.: 362 (1963); FILSON, Checklist Austr. Lich. 1. ed.: 48 (1983); HERTEL, Beih. Nova Hedwigia 79: 466 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 61 (1986); Austr. Fl. Fauna Ser. 4: 122 - 123 (1986); Checklist Austr. Lich. 3. ed.: 104 (1988).

Type: AUSTRALIA: New South Wales: Eastern Creek, 1892, F.R.M. Wilson (H!, holotype) - [not analyzed chemically].

= *Lecidea ramosella* Räs.

RÄSÄNEN, Arch. Soc. Zool. Bot. Fenn. Vanamo 3: 182 - 183 (1949); LAMB, Index Nom. Lich.: 376 (1963); FILSON, Checklist Austr. Lich. 1. ed.: 49 (1983); HERTEL, Beih. Nova Hedwigia 79: 465 (1984); FILSON, Checklist Austr. Lich. 2. ed.: 63 (1986); Austr. Fl. Fauna Ser. 4: 128 (1986); Checklist Austr. Lich. 3. ed.: 106 (1988).

Type: AUSTRALIA: Queensland: Brisbane, Heliend, 1890, leg. F.R.M. Wilson (H!, holotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: rimose to areolate, occasionally ±cryptothalline, up to several cm diam., 0.1 - 1.0 mm thick.

AREOLES: irregularly shaped, light grey to greyish, sometimes partly rusty coloured, plane to irregularly convex, with rough to smooth surface, c. 0.4 - 1.0 (- 1.5) mm, max. 0.7 - 2.0 (- 3.0) mm diam. Cortex 10 - 30 µm thick; upper cell layer not pigmented; hyphae c. 3 - 3.5 µm diam.; epinecral layer not developed. Algal layer c. 40 - 100 µm thick; algal cells c. 9 - 10 µm, max. 11 - 13 µm diam. Medulla 1 -; hyphae c. 3 - 5 µm thick.

HYPOTHALLUS: grey to black, obvious between the areoles and at the thallus margin or not developed.

Apothecia: roundish to characteristically auriculate, dispersed to crowded, 10 - 150/cm², sessile, mostly not constricted at the base, c. 0.4 - 1.5 mm, max. 0.8 - 2.0 (- 4.5) mm diam. Disc plane, black to red, matt, epuriose or with grey to rusty coloured pruina. Margin distinct and persistent, dark grey to black, matt.

EXCIPULUM: max. 30 - 140 µm, lateral of hymenium 30 - 100 µm thick. Ectal zone black-brown; pigmented zone (10 -) 15 - 25 (- 40) µm tall; hyphae 3.5 - 5 µm diam., with lumina of 1.3 - 2 µm. Inner zone pale brown to black-brown; hyphae 2 - 3 (- 5) µm diam., with lumina of c. 1 - 2.5 µm. Medullary zone not obvious.

HYPOTHECIUM: dark brown, 100 - 220 (- 400) µm thick; hyphae c. 3 µm diam.; subhymenial layer colourless to pale brown, 30 - 100 (- 120) µm thick.

HYMENIUM: (35 -) 40 - 65 (- 80) µm tall, colourless, I+ blue, Iconc.+ blue. Epihymenium brown-black, occasionally incrustated with rusty coloured granula, 8 - 15 µm tall. Paraphyses more or less branched, rarely anastomosing, 1.5 - 2 µm, apices 2.5 - 3.5 (- 4) µm thick. Asci c. 30 - 60 x 9 - 15 µm; tholus max. 10 - 12 µm, min. 5 - 7 µm thick; amyloid tube c. 2- 4 µm broad; outer amyloid wall layer c. 1 µm thick,

I+ blue, I_{conc.}+ blue-brown; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 10 - 18 x 5 - 8 μ m.

Pycnidia: immersed. Conidia filiform, c. 10 - 15 - 18 - 20 x 1 - 1.2 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

Two chemotypes observed:

- a) containing confluent acid (major), 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid (minor) (306 specimens examined);
- b) containing 2'-O-methylperlatolic acid (127 specimens examined);
- both chemotypes occasionally with traces of norstictic or gyrophoric acid.

DISTRIBUTION:

Eastern Asian (?). *P. leptocarpa* is one of the most common saxicolous lichens, occurring in continental Australia from temperate to tropical regions below the alpine zone. It grows on siliceous rocks and boulders in a semi-exposed to sheltered position in forests as

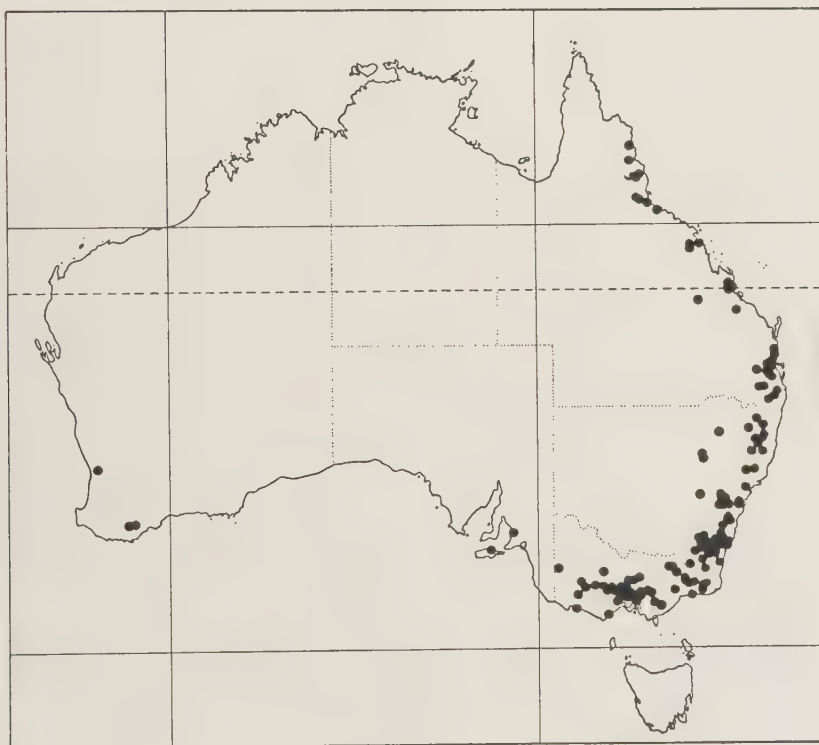


Fig. 25. *Parapropidia leptocarpa*. (GR 3709, M) Scale = 1 mm.

well as in open locations, typically as a pioneer on more or less disturbed surfaces. Moreover the species is known to occur in Tasmania, New Zealand (HERTEL 1984: 465) and New Caledonia (described as *Lecidea ferricola*), as well as from China (Yünnan) (described as *L. lividonigra* and *L. tuberculans*). No reports exist from South Africa and South America. Within continental Australia, *P. leptocarpa* has been found in W.A., S.A., Qld, N.S.W., A.C.T. and Vic. (map 49).

NOTES:

P. leptocarpa is easily to recognize, usually by morphological features alone. Older apothecia often become extremely auriculate (see fig. 25) and a considerable number of the specimens analyzed showed apothecia with a rusty coloured disc. The specific epithets of two synonymous taxa refer to this phenomenon: *L. blastenoides*, described from New Zealand (*Blastenia* Massal. is a synonym of *Caloplaca* Th. Fr.



Map 49. Distribution of *Parapropidia leptocarpa* in continental Australia

with mostly reddish coloured apothecia) and *L. ferricola*, described from New Caledonia. The rusty colour is caused by the accumulation of iron-containing granula. It is not clear, whether these particles are - what seems less likely - segregated by the hymenium, or are external depositions.

The combination of a dark brown hypothecium, blackish-brown excipulum and epihymenium, a $1 \pm$ bluish hymenium, and non-halonate spores, characterizes this species well. The two main chemotypes show the same distribution patterns, co-occur in the same populations, and are not distinguishable anatomically from another. Norstictic acid and gyrophoric acid, which occasionally were found in both chemical strains, either represent real accessory secondary products or may be contaminations by particles of other lichens, e.g. lichenicolous species.

SPECIMENS EXAMINED:

Chemotype a) : confluent acid (major), 2'-O-methylperlatolic acid (minor), 2'-O-methylmicrophyllinic acid (minor, traces):

Western Australia: John Forrest National Park, NE of Perth, [31°44'S, 116°05'E], low conglomerate boulders in sclerophyll forest, 3.iv.1986, leg. G.Rambold 5437, 5441 (M); -- Stirling Range National Park, Bluff Knoll, 34°23'S, 118°15'E, exposed sandstone outcrops on peak SW of summit, c. 1000 m, 3.iv.1986, leg. G.Rambold 5406 (M); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, leg. G. Rambold 5324 (M, PERTH), 5342, 5348, 5354 (M).

South Australia: Mt Bonython, N of Mt Lofty E of Adelaide, [34°58'S, 138°40'E], [no date], leg. R.D.Seppelt 534 (MEL); -- Greenhill Road, near Mt Bonython, [34°58'S, 138°42'E], 27.vi.1967, leg. E.Beard (BRIU, MEL 1023121); -- Mt Bonython, N of Mt Lofty E of Adelaide, [34°58'S, 138°42'E], [no date], leg. R.D.Seppelt 532, 533, 540 (MEL); -- Summit of Mt Crawford, Mt Lofty Ranges, [35°00'S, 138°40'E], 2.ix.1977, leg. J.A.Elix 3814 (ANUC); -- 4 km W of Carey Gully, along the Forest Range road, 456 m, 21.xii.1976, leg. J.A.Elix 2818 (ANUC); -- Fleurieu Peninsula, c. 8 km NE of Waitpinga (W. is c. 75 km S of Adelaide), 10.xi.1966, leg. N.N.Donner 1941 (AD); -- Kangaroo Island, just S of Wisanger Hills H.S., 7 km WSW of Emu Bay, 35°37'S, 137°27'E, 80 m, 27.x.1985, leg. J.A.Elix 19639, 19642 (ANUC).

Queensland: Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. J.A.Elix 17301 (ANUC); -- Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. H.Streimann 30703, 30718 (CBG); -- Near summit of Mt Leswell, 32 km S of Cooktown, 15°46'S, 145°15'E, 440 m, 5.vii.1984, leg. J.A.Elix 17354 (ANUC); -- Near the summit of Mt Walker, 34 km S of Cooktown, 15°48'S, 145°15'E, 480 m, 5.vii.1984, leg. J.A.Elix 17381 (ANUC); -- Mt Walker, 34 km S of Cooktown, 15°48'S, 145°15'E, 480 m, 5.vii.1984, leg. H.Streimann 30976 (CBG); -- Main Coast Range, Mary Creek, 15 km NNW of Mt Molloy, 16°32'S, 145°16'E, 1160 m, 20.vi.1984, leg. J.A.Elix 16948 (ANUC); -- Bellenden Ker Range, Bellenden Ker Centre Peak, 17°16'S, 145°51'E, granite boulders on walking trail between cable car tower "6" and Telecom Station near summit, 1480 - 1560 m, 3.iii.1986, leg. G.Rambold 4898, 4899, 4900, 4901, 4902, 4903, 4905, 4908, 4913, 4921 (M); -- Atherton Tablelands, Mt Baldy, 8 mi SW of Atherton, [17°20'S, 145°25'E], 17.iv.1968, leg. W.A.Weber (COLO L-18167); -- Wild River, Herberton, 17°23'S, 145°23'E, 880 m, 1.vii.1984, leg. J.A.Elix 17016 (ANUC); -- Atherton Tablelands, Bellenden Ker Range, Bartle Frere North West Peak, 17°23'S, 145°48'E, exposed granite outcrops near peak, c. 1500 m, 1.iii.1986, leg. G.Rambold 4839 (M); -- Hugh Nelson

Range, along Plath Road, 15 km S of Atherton, 17°25'S, 145°26'E, 1080 m, 25.vi.1984, leg. J.A.Elix 16428 (ANUC); Poverty Creek, 41 km WSW of Ingham, 18°43'S, 145°47'E, 640 m, 19.i.1984, leg. H.Streimann 28481 (CBG); -- Crystal Creek National Park, Paluma, 19°00'S, 146°13'E, exposed granite rocks at Witt's Lookout, c. 900 m, 25.ii.1986, leg. G.Rambold 4789, 4795, 4798, 4800 (M, BRI), 4794, 4796, 4799 (M); -- Mt Stuart, 10 km SSW of Townsville, 19°21'S, 146°47'E, 570 m, 9.vii.1984, leg. H.Streimann 31287 (CBG, H); -- Cape Hillsborough National Park, 30 km N of Mackay, Hidden Valley, 20°55'S, 149°03'E, conglomerate rocks in rainforest with *Ptychosperma elegans*, 10 m, 21.ii.1986, leg. G.Rambold 4655 (M, BRI); -- Eungella National Park, NW of Mackay, Mt Dalrymple, 21°02'S, 148°38'E, granite outcrops on summit, 1240 m, 20.ii.1986, leg. G.Rambold 4612, 4620 (M); -- Rosslyn Bay, Double Head, 35 km NE of Rockhampton, 23°10'S, 150°48'E, rocky outcrops on top of hill, c. 50 m, 13.ii.1986, leg. G.Rambold 4465, 4469 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, leg. G.Rambold 4438 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, vertical and overhanging surface of E exposed rocky outcrops, 480 m, 13.ii.1986, leg. G.Rambold 4450 (M); -- Blackdown Tableland National Park, Rainbow Fall Lookout, 23°51'S, 149°06'E, outcrops of sandstone, c. 600 m, 14.ii.1986, leg. G.Rambold 4497, 4512, 4515 (M); -- Kroombit Tops National Park, 2 km S of Forestry Barracks, 24°22'S, 151°00'E, c. 900 m, 3.ix.1985, leg. R.W.Rogers 7900 (BRIU); -- Noosa Heads National Park, Noosa Hill Track, [26°20'S, 153°03'E], 30 m, 31.viii.1982, leg. J.A.Elix 10371 (ANUC); -- Noosa Heads National Park, Tanglewood Track, [26°23'S, 153°07'E], 20 m, 30.viii.1982, leg. J.A.Elix 10358 (ANUC); -- Noosa Hill, Noosa National Park, 26°33'S, 153°07'E, 50 m, 28.ix.1985, leg. R.W.Rogers 7966 (BRIU); -- Mt Coolum, c. 90 km N of Brisbane, 26°34'S, 153°05'E, basaltic outcrops near summit in low heathland, c. 180 m, 11.ii.1986, leg. G.Rambold 4408, 4418 (M, BRI); -- Mt Beerwah, highest of the Glasshouse Mountains, NW side of summit, [26°54'S, 152°57'E], c. 1800 ft, 22.ix.1968, leg. J.H.Willis (MEL 1000002); -- Glasshouse Mtns, about 3 km S of Crookneck Mtn (Coonowrin), 26°57'S, 152°56'E, c. 100 m, 26.vii.1986, leg. J.Hafellner 15793 (hb. Hafellner); -- Glasshouse Mtns, N-facing hills SSW of Tibrogargan Mtn, 26°57'S, 152°56'E, 100 - 150 m, 19.viii.1986, leg. J.Hafellner 15704, 15727 (hb. Hafellner); -- Glasshouse Mtns, N-facing hills S of Tibrogargan Mtn, [26°57'S, 152°56'E], c. 100 m, 19.viii.1986, leg. J.Hafellner 15557, 15567 (hb. Hafellner); -- Glasshouse Mtns, about 3 km S of Crookneck Mtn (Coonowrin), 26°58'S, 152°56'E, c. 100 m, 26.vii.1986, leg. J.Hafellner 15796 (hb. Hafellner); -- Mt Mee State Forest, about 3 km W of the forest station, 27°04'S, 152°44'E, 500 m, 13.viii.1986, leg. J.Hafellner 15629 (hb. Hafellner); -- Woodford Road N of Dayboro, Terrors Creek, 27°09'S, 152°50'E, c. 300 m, 13.viii.1986, leg. J.Hafellner 15661 (hb. Hafellner); -- Perserverance Dam, W of the dam wall, 27°17'S, 152°08'E, 500 m, 4.ix.1986, leg. R.W.Rogers 8381, 8386, 8393 (BRIU); -- Perserverance Dam SE of Crows Nest, 27°17'S, 152°08'E, c. 480 m, 4.ix.1986, leg. J.Hafellner 15395, 15399 (hb. Hafellner); -- Mt Glorious, c. 2 km W of Maijala picnic area, 27°18'S, 152°45'E, 800 m, 17.v.1983, leg. R.W. Rogers 2579 (BRIU); -- Junction of Mt Glorious - Samford roads, 27°21'S, 152°46'E, 700 m, 15.vi.1983, leg. R.W.Rogers 2627 (BRIU); -- Junction of Mt Nebo and Samford PE 1 Road, Mt Glorious, 27°21'S, 152°46'E, 28.viii.1984, leg. C.H.Miller 102 (CANB); -- Bellbird Grove State Park E of Mt Nebo Road, NW of Brisbane, 27°25'S, 152°53'E, c. 400 m, 1.viii.1986, leg. J.Hafellner 15865 (hb. Hafellner); -- Brisbane, Hillend, [27°28'S, 153°00'E], [no date], leg. F.M.Bailey (BRI 354975); -- Brisbane, Hillend, [27°30'S, 153°00'E], iv.1888, leg. J.Shirley (NSW 155915); -- Hillend, Brisbane, [27°30'S, 153°00'E], 1896, leg. F.R.M.Wilson (NSW 180247); -- Hillend, [27°30'S, 153°00'E], [no date, no collector] (NSW 155923); -- North face of Mt French, Mt French National Park, near Boonah, 27°59'S, 152°37'E, 200 m, 10.iv.1985, leg. R.W.Rogers 7686 (BRIU); -- Cunningham Gap National Park, S exposed ridge of Mt Cordeaux, 28°02'S, 152°23'E, c. 1000 m, 17.ix.1986, leg. J.Hafellner 15343 (hb. Hafellner); -- Mt Cordeaux, summit track, 28°04'S, 152°24'E,

c. 800 m, 17.ix.1986, leg. R.W.Rogers 8490, 8491, 8492, 8497, 8499, 8511 (BRIU); -- 5 km N of Numinbah Valley along Nerang River, [28°08'S, 153°14'E], 120 m, 20.viii.1976, leg. J.A.Elix 2546 (ANUC); -- Springbrook, 28°14'S, 153°18'E, c. 600 m, 17.i.1982, leg. R.W.Rogers 2699 (BRIU).

New South Wales: Tweed Range, Border Ranges National Park NE of Wiangaree, The Pinnacle, 28°23'S, 153°07'E, c. 1000 m, 31.viii.1986, leg. J.Hafellner 15507, 15508, 15511 (hb. Hafellner); -- Richmond Range State Forest, Toonambar Dam, 28°37'S, 152°48'E, sandstone rock on clay road cutting, 8.ii.1986, leg. G.Rambold 4369, 4372, 4374 (M), 4370, 4375 (M, NSW), 4377 (Hertel, Lecideac. Exs. in prep.); -- 50 km E of Glenn Innes, along Hwy 38, [29°35'S, 152°08'E], 1000 m, 18.viii.1976, leg. J.A.Elix 2448 (ANUC); -- Kaputar National Park, "The Gins" 30°07'S, 150°04'E, 1100 m, 13.vii.1986, leg. P.Merrottsy 274 (BRIU); -- 15 km W Dorrigo, along Armidale road, [30°22'S, 152°33'E], 1110 m, 17.viii.1976, leg. J.A.Elix 2334 (ANUC); -- New England National Park, Point Lookout, 30°29'S, 152°25'E, basaltic boulders in dry sclerophyll forest, c. 1563 m, 6.ii.1986, leg. G.Rambold 4315, 4322, 4335 (M); -- 55 km W of Dorrigo along Armidale road, [30°30'S, 152°15'E], 1308 m, 17.viii.1976, leg. J.A.Elix 2367 (ANUC); -- New England, Armidale Distr., Wollomombi Falls Reserve E of Armidale, Edgars Lookout, 30°31'S, 152°03'E, 950 m, 12.x.1981, leg. H.Mayrhofer 3445 (GZU); -- Wollomombi Falls, 26 mi E of Armidale, [30°31'S, 152°03'E], 24.x.1968, leg. W.A.Weber & D.McVean (COLO L-49883); -- North coast, Mt Boss, 43 km NW of Wauchope, 31°09'S, 152°23'E, 40 m, 20.x.1978, leg. D.Verdon 4013 (CBG, M); -- Mt Boss, 43 km NW of Wauchope, 31°09'S, 152°23'E, 40 m, 20.x.1978, leg. D.Verdon 4013 (CBG, M); -- Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4283, 4298, 4306 (M); -- Castlereagh River, 8 km W of Coonabarabran, 31°15'S, 149°11'E, 600 m, 26.viii.1979, leg. H.Streimann 9277 (CBG); -- Greenbah Creek, 29 km S of Coonabarabran, 31°30'S, 149°15'E, 450 m, 6.ix.1979, leg. H.Streimann 9454 (CBG, H, M, US); -- Uppermost river crossing Gloucester Tops road, 32°05'S, 151°35'E, 29.iii.1970, leg. R.Filson 11654, 11655 (MEL); -- Barrington Tops National Park, Gloucester Tops, Negrohead Beech Forest Walking Trail, 32°05'S, 151°35'E, c. 1200 m, 4.ii.1986, leg. G.Rambold 4227, 4235, 4236 (M), 4258 (M, NSW); -- Newcastle near Bulladelah, round Clarks Guest House, ii.1966, leg. D.J.Hill (BM - 5 specimens); -- Mt Canobolas, 8 km SW of Orange, 33°19'S, 149°00'E, 1390 m, 8.viii.1979, leg. H.Streimann 9239 (CBG); -- Dharug National Park, 7 km E of Wiseman's Ferry, [33°20'S, 151°06'E], 5.ii.1977, leg. J.A.Elix 2901 (ANUC); -- Western face of Mt Canobolas, 8 km SW of Orange, [33°22'S, 149°00'E], 1420 m, 8.viii.1979, leg. J.A.Elix 6280 (ANUC); -- Blue Mountains National Park, Explorers Range S Mount Wilson, Mt Banks, 33°35'S, 150°22'E, c. 850 - 900 m, 6.viii.1988, leg. H.Mayrhofer 7919, 7925 (GZU); -- Blue Mountains, Hat Hill 4 km ENE of Blackheath, 33°36'S, 150°19'E, rocky outcrops, 1033 m, 1.ii.1986, leg. G.Rambold 4159, 4160 (M); -- Blue Mountains, 4 km SE of Blackheath, walking track from Neates Glen via Grand Canyon to Evans Lookout, [33°40'S, 150°18'E], c. 900 - 1000 m, 3.i.1985, leg. H.Mayrhofer 6695 (GZU); -- 3 mi E of Dural, c. 15 mi NW of Sydney, [33°41'S, 151°05'E], 2.ii.1964, leg. B.Briggs (NSW 180252); -- Blue Mountains, Springwood c. 80 km W of Sydney, Martins Lookout to Glenbrook Creek, [33°42'S, 150°34'E], ix.1981, leg. M.Mayrhofer 3228 (GZU); -- Blue Mountains, Katoomba, below Echo Point, [33°43'S, 150°19'E], 9.viii.1981, leg. D.L.Hawksworth 5136 (BM); -- Blue Mountains, Springwood, Martins Lookout to Glenbrook Creek, 33°43'S, 150°33'E, on exposed sandstone rocks, 31.i.1986, leg. G.Rambold 4084, 4101 (M), 4107 (M, NSW); -- Peckmans Plateau, Katoomba, [33°43'S, 150°19'E], 980 m, 24.iv.1977, leg. J.A.Elix 3189, 3262 (ANUC); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S facing outcrops of sandstone, 905 m, 1.ii.1986, leg. G.Rambold 4122 (M, NSW); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, SE facing sandstone rock walls beside Dardanelles Pass, Walking Track, 760 - 900 m, 1.ii.1986, leg. G.Rambold 4129 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing sandstone

cliffs between "The Three Sisters" and "Echo Point", 920 m, 1.ii.1986, leg. G.Rambold 4140, 4147 (M); -- Blue Mountains, "Narrow Neck", 4.5 km SW of Katoomba, 33°45'S, 150°16'E, sandstone outcrops beside road, c. 1000 m, 2.ii.1986, leg. G.Rambold 4212 (M); -- Blue Mountains National Park, near Glenbrook, c. 60 km W of Sydney, [33°46'S, 150°37'E], ix.1981, leg. M.Mayrhofer 3269 (GZU); -- Jenolan Caves, [33°49'S, 150°02'E], ix.1897, leg. F.R.M.Wilson (NSW 180035); -- [near] Sydney [33°53'S, 151°13'E], [no date], leg. Ch. Knight (type of *Lecidea microspora* Knight, M); -- Peakhurst near Sydney, 23.ix.1900, [no date, no collector] (BRI 354951); -- Hill Top, [34°21'S, 150°30'E], viii.1913, leg. E.Cheel (NSW 180259); -- Bowral, [34°29'S, 150°25'E], 31.viii.1907, leg. E.Cheel (NSW 155799); -- 4 km E of Robertson, [34°35'S, 150°35'E], 730 m, 17.ix.1980, leg. J.A.Elix 8921 (ANUC); -- Braidwood Distr., Pigeon House, range between Nerriga and Sassafras, 1.x.1967, leg. W.A.Weber & D.McVean (COLO L-49034, L-49037, L-49040); -- Morton National Park, 7 km NE of Nerriga, 760 m, 18.x.1981, leg. V. Wirth 11080 (STU); -- Along the banks of the Endrick River, 5 km NE of Nerriga, [35°05'S, 150°10'E], 30.iii.1977, leg. J.A.Elix 3098 (MEL); -- Along Braidwood to Nowra road, 28 km from Nerriga towards Nowra, 35°07'S, 150°20'E, 750 m, 31.x.1978, leg. D.Verdon 4119 (CBG); -- Blue Range, 25 km WNW of Canberra, 35°17'S, 149°50'E, 1220 m, 25.iv.1980, leg. H.Streimann 10177 (CBG, M); -- Along the trail to Pigeon House Mtn, 15 km W of Ulladulla, [35°21'S, 150°29'E], 450 m, 29.ix.1977, leg. J.A.Elix 3903 (ANUC); -- Great Dividing Range, 13 km E of Bungendore, [35°26'S, 149°39'E], 820 m, 23.iii.1977, leg. J.A.Elix 2995 (ANUC); -- Turallo Range, along Hoskinstown - Braidwood road, 2 km from Ralpine Valley towards Braidwood, 35°27'S, 149°36'E, 970 m, 20.vi.1977, leg. D.Verdon 2807 (CBG); -- Clyde Mtn road, Clyde Mtn Pass, 18.5 km SE of Braidwood, 35°33'S, 149°57'E, 714 m, 2.ix.1981, leg. D.Verdon 4998 (CBG, H, NY); -- Clyde Mtn, 20 km SE of Braidwood, [35°35'S, 150°00'E], c. 720 m, 2.ix.1981, leg. M. & H.Mayrhofer 4600 (GZU); -- Great Dividing Range, 6 km E of Captains Flat, 35°35'S, 149°30'E, 1220 m, 25.x.1979, leg. H.Streimann 9505a (CBG, H); -- Great Dividing Range, 2 km N of Parkers Gap, 10 km E of Captains Flat, 1160 m, 5.viii.1981, leg. J.A.Elix 9095 (ANUC); -- Great Dividing Range, 5 km N of Parkers Gap, 10 km E of Captains Flat, 35°38'S, 149°31'E, 1250 m, 18.x.1981, leg. V.Wirth 11059 (STU); -- Currowan State Forest, 14 km NW of Braidwood, 35°36'S, 150°05'E, 180 m, 31.viii.1981, leg. H.Streimann 15668 (CBG, H); -- Kioloa State Forest, Durras North - Princess Highway road, 35°37'S, 150°16'E, rocks on road cutting in tall wet *Eucalyptus* forest, 70 m, 22.i.1986, leg. G.Rambold 3781, 3782, 3783, 3784, 3785, 3786, 3787, 3790, 3791, 3793, 3794, 3795, 3796 (M); -- Central Tablelands, Fitzroy Falls, 16 km SE of Moss Vale, 35°38'S, 150°28'E, 753 m, 26.viii.1977, leg. D.Verdon 3053 (CBG); -- Braidwood Distr., Budewang Range between Majors Creek and Araluen, [35°39'S, 149°49'E], 18.x.1967, leg. W.A.Weber & D.McVean (COLO L-49241); -- Currowan State Forest, 12 km W of Neilligen, [35°39'S, 150°08'E], 120 m, 14.i.1977, leg. J.A.Elix 2878 (ANUC, MEL); -- Mongorlowe River, 20 km SE of Braidwood, 35°40'S, 149°53'E, 250 m, 21.xi.1979, leg. H.Streimann 9695 (CBG, M), (Hertel, *Lecideac* Exs. 68, M); -- South coast, Buckenbowra River, 7.5 km NW of Batemans Bay, 35°41'S, 150°06'E, 5 m, 8.iv.1981, leg. D.Verdon 4961 (CBG, H, LSU, M, NICH); -- Gourock Range, along Cowangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G.Rambold 3953, 3958, 3964, 3966, 3969 (M); -- Merricumbene Fire Trail 14 km SW of Araluen, 35°44'S, 149°53'E, 100 m, 16.xi.1978, leg. H.Streimann 7312a (CBG, M, NICH); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3920, 3928, 3930, (M); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3749 (M); -- Southern Tablelands, 14 km N of Adaminaby on Yaouk Road, 35°52'S, 148°47'E, c. 1130 m, 18.viii.1975, leg. D.Verdon 1726 (CBG, H), 1736 (CBG); -- Along the trail to Marble Arch, 48 km S of Braidwood,

[35°55'S, 149°50'E], 700 m, 2.iii.1978, leg. J.A.Elix 4389 (ANUC); -- Hanging Mtn, 20 km SW of Moruya, 35°59'S, 149°53'E, 750 m, 26.xi.1981, leg. D.Verdon 5088 (CBG); -- Hanging Mtn, 20 km SW of Moruya, 35°59'S, 149°53'E, 750 m, 26.xi.1981, leg. H.Streimann 15903 (CBG, H); -- Big Badja Mtn, 78 km S of Braidwood, [36°00'S, 149°34'E], 1362 m, 2.iii.1978, leg. J.A.Elix 4495 (ANUC); -- Great Dividing Range, Big Badja Hill, 47 km NE of Cooma, 36°00'S, 149°34'E, 1360 m, 2.iii.1978, leg. D.Verdon 3481 (CBG); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m, 19.i.1986, leg. G.Rambold 3699, 3701 (M), 3708 (M, NSW); -- Mt Dromedary, 13 km SW of Narooma, 36°18'S, 150°02'E, 870 m, 27.ix.1983, leg. H.Streimann 28015 (CBG); -- Kosciusko National Park, Diggers Creek SE of Island Bend, 36°20'S, 148°29'E, 1380 m, 3.iii.1985, leg. H.Hertel 31908 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3609 (M); -- Kosciusko National Park, Diggers Creek, near road to Charlottes Pass, 36°22'S, 148°29'E, c. 1500 m, 1.iii.1985, leg. H.Hertel 32041 (M); -- Steeple Flat, 10 km SE of Nimmitable, 36°32'S, 149°21'E, 1100 m, 16.vii.1975, leg. D.Verdon 1438 (CBG, M); -- Brown Mtn, above the road, [36°36'S, 149°23'E], 1156 m, 20.i.1976, leg. J.A.Elix 1543 (ANUC); -- Brown Mtn, below road, 36°36'S, 149°23'E, 975 m, 20.i.1976, leg. J.A.Elix 1574 (ANUC); -- Bondi State Forest, 45 km S of Bombala along the Cann Valley River Highway, [37°15'S, 149°17'E], 23.xi.1978, leg. J.A.Elix 5409 (ANUC); -- [same locality, same date], leg. D.Verdon 4356 (CBG); -- Hornsby Junction, ix.1897, leg. F.R.M.Wilson (NSW 180033); -- Near Mt Bouddi, Bouddi National Park, 7.v.1978, leg. J.A.Elix 4654 (ANUC); -- [no locality, no date], leg. Ch.Knight (type of *Lecidea microspora* Knight, WELT).

A.C.T.: Jervis Bay Territory, 4 km E of Jervis Bay, 35°08'S, 150°45'E, coastal rocks "Hole in the Wall", on horizontal surface, 5 m, 23.i.1986, leg. G.Rambold 3839 (CBG, M, MEL); -- Jervis Bay Territory, Moes Rock, near Cape St George, 35°09'S, 150°46'E, coastal rocks, 0 m, 23.i.1986, leg. G.Rambold 3844, 3845, 3849, 3850 (M); -- Jervis Bay Territory, Australian National Botanic Gardens, Jervis Bay Annexe, 35°09'S, 150°42'E, 30 m, 23.i.1986, leg. G.Rambold 3879, 3880 (M); -- Jervis Bay Territory, Stony Creek near Cape St George, 35°10'S, 150°46'E, rocks and boulders beside creek, 10 m, 23.i.1986, leg. G.Rambold 3866, 3869, 3870, 3875 (M), 3868 (CBG, M); -- Mt Ainslie, 5 km NE of Canberra, 35°15'S, 149°09'E, 800 m, 26.vii.1981, leg. H.Streimann 11563 (CBG, M); -- Molonglo Gorge Reserve, 14 km E of Canberra, 35°16'S, 149°16'E, 650 m, 27.i.1984, leg. J.A.Elix 11786 (ANUC); -- Black Mtn, 5 km NW of Canberra, 35°16'S, 149°06'E, 780 m, 15.vi.1980, leg. H.Streimann 10297 (CBG, H, M); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, 1420 m, 18.xii.1985, leg. J.A.Elix 19772 (ANUC); -- Blue Range, 24 km WNW of Canberra, 35°18'S, 149°51'E, 25.iv.1980, leg. H.Streimann 10190 (CBG, M); -- Brindabella Range, 1.5 km S of Mt Coree, 31 km W of Canberra, 35°19'S, 148°49'E, on road cutting on Curries Road (Rhyolite), 1300 m, 27.i.1986, leg. G.Rambold 4071, 4072, 4074, 4075, 4076, 4077 (M), 4073 (CBG, M); -- Booroomba Rocks 30 km SSW of Canberra, 35°32'S, 149°00'E, 1150 m, 11.vii.1979, leg. H.Streimann 9085 (CBG, NICH); -- Along Kangaroo Creek near Corin Dam, [35°34'S, 148°50'E], 1000 m, 25.xi.1975, leg. J.A.Elix 1367 (ANUC); -- Along trail to Booroomba Rocks, 11 km SW of Tharwa, [35°36'S, 149°00'E], 1300 m, 11.vii.1979, leg. J.A.Elix 6198 (ANUC); -- 2 km before Honeysuckle Break Tracking Station, below road, 3200 ft, 20.i.1975, leg. J.A.Elix 553 (ANUC).

Victoria: Red Bluff, about 50 mi NW of Kaniva, 17.xi.1971, leg. R.Filson 14343, 14344 (MEL); -- Mitta River Banks, c. 1.5 mi S of Mitta Mitta, [36°32'S, 147°27'E], 1000 ft, 18.xi.1964, leg. J.H.Willis (MEL 1018453); -- Little Desert, 3 mi W of Kaniva - Edenhope road, 17 mi S of Kaniva, [36°33'S, 141°15'E], 18.xi.1971, leg. R.Filson 14390 (MEL); -- On road from Omeo to Corroyong, c. 10 km S of Sassafras Gap (75 km S of Corroyong), 36°39'S, 147°42'E, c. 800 m, 28.ii.1985, leg. H.Hertel 31591, 31593 (M); -- Strathbogie Range, 21 km E of Euroa along the Merton

Road, [36°55'S, 145°40'E], 508 m, 6.xii.1976, leg. J.A.Elix 2745 (ANUC); -- Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3312 (M); -- Mac Killop Bridge, 14 km E of Wulgulmerang, 37°05'S, 148°25'E, 200 m, 12.i.1986, leg. G.Rambold 3342, 3343 (M); -- Tallarook, [37°06'S, 145°06'E], 29.vii.1978, leg. J.A.Elix 4869 (ANUC); -- The Grampian Mtns, [37°08'S, 142°26'E], 22.v.1963, leg. S.L.Thrower (BM); -- Dead Bullock Creek, near Roses Gap Road, The Grampians, [37°08'S, 142°26'E], 28.v.1963, leg. T.B.Muir 2848 (MEL 1048325); -- Strawberry Gully, 70 km NE of Orbost, Bonang Hwy, 37°09'S, 148°44'E, 4.iv.1980, leg. H.Streilmann 10005 (CBG); -- 16 km SE of Wulgulmerang, 37°09'S, 148°25'E, small boulders in tall open *Eucalyptus* forest along Deddick Track (S of Bowen Track), 800 - 900 m, 12.i.1986, leg. G.Rambold 3359 (M); -- Roadside Stop, Mt Cole State Forest, 25 km E of Ararat, 37°14'S, 143°14'E, 19.viii.1981, leg. M.& H.Mayrhofer 2899 (GZU); -- Gramplians, summit of Mt William, 37°18'S, 142°36'E, 1168 m, 9.i.1984, leg. J.A.Elix 11544, 11545 (ANUC); -- Cann River Hwy, 25 km from Cann River town towards Bombala, 37°20'S, 149°13'E, 450 m, 23.xi.1978, leg. D.Verdon 4342 (CBG); -- Daylesford, at Sutton Springs, [37°21'S, 144°09'E], 4.iv.1947, leg. J.H.Willis (MEL 515873); -- Daylesford, [37°21'S, 144°09'E], x.1944, leg. C.French (UPS); -- Great Dividing Range, Hanging Rock E of Woodend, about 70 km NE of Melbourne, 37°22'S, 144°40'E, c. 500 m, 18.vii.1986, leg. J.Hafellner 15755 (hb. Hafellner); -- Hanging Rock, near Macedon, [37°22'S, 144°40'E], 11.xi.1961, leg. S.L.Thrower (BM); -- Mt Macedon, [37°23'S, 147°37'E], 9.v.1885, leg. F.R.M.Wilson (NSW 155919); -- "Three Sisters", Three Sisters Track, 23 km NNE of Cann River, 37°23'S, 149°06'E, 920 m, 27.ix.1985, leg. J.A.Elix 19539 (ANUC); -- Cockpit, Macedon, [37°23'S, 144°37'E], 11.ii.1901, leg. R.A.Bastow 68 (MEL); -- Mt Macedon, 15.ii.1908, leg. E.Cheel (NSW 155754); -- Mt Macedon, 9.v.1885, leg. F.R.M. Wilson (NSW 155916); -- Mt Macedon, 1887, leg. F.R.M.Wilson (NSW 155781); -- Buxton, Cathedral Range, Sugarloaf Peak, 37°24'S, 145°45'E, 11.x.1981, leg. V.Wirth 10959 (STU); -- Cockpit Macedon, [37°25'S, 144°34'E], 11.ii.1901, leg. R.A.Bastow 63 (MEL); -- Slaty Creek, c. 4 mi SE of Creswick, slopes near Wolfe's Reef and Dam, [37°26'S, 144°00'E], 10.iv.1971, leg. J.H.Willis (MEL 40227); -- Enochs Point, 9 mi SSW of Jamieson, [37°26'S, 146°06'E], 17.iv.1965, leg. A.Morrison (MEL 1018455); -- Creswick, Government Dam, [37°26'S, 143°54'E], 7.iv.1947, leg. J.H.Willis (MEL 1018413); -- Kinglake National Park near Melbourne, x.1947, leg. P.Bibby (MEL 7250); -- Kinglake National Park, near Melbourne, x.1947, leg. P.Bibby 20 (UPS); -- Baw Baw National Park, 6 km SE of Mt Erica, 37°35'S, 146°23'E, on clay road cutting on Mt Erica Road, 900 - 1000 m, 10.i.1986, leg. G.Rambold 3239, 3240, 3241 (M), 3242 (M, MEL); -- Melbourne, Mt Donna Buang, [37°42'S, 145°41'E], iii.1963, leg. P.W.James (BM - 2 specimens); -- Mt Raymond, 13 km E of Orbost, 37°43'S, 148°36'E, 290 m, 27.ix.1985, leg. J.A.Elix 19449 (ANUC); -- Werribee Gorge near Bacchus Marsh, 37°45'S, 144°40'E, xi.1970, leg. R.C.Weeks (HO); -- Yarra, Warburton, [37°45'S, 145°42'E], xii.1885, leg. F.R.M. Wilson (NSW 155914); -- Kew, [37°48'S, 145°01'E], ix.1888, leg. F.R.M. Wilson (NSW 155921); -- Kew, [no date], leg. F.R.M. Wilson (NSW 155913); -- Kew, 11.vii.1887, leg. F.R.M. Wilson (NSW 155910); -- Kew, vi.1885, leg. F.R.M. Wilson (NSW 155762); -- Kew Asylum grounds, [37°50'S, 145°00'E], 27.x.1900, leg. R.A.Bastow (MEL 6982); -- Baw Baw Mtns, near Noojee, 18.x.1964, leg. S.L.Thrower 951 (BM); -- Brisbane Ranges, Little River Gorge, c. 25 km S of Bacchus Marsh, 37°51'S, 144°22'E, 18.x.1981, leg. H.Mayrhofer 3017 (GZU); -- Gembrook, [37°57'S, 145°33'E], 27.x.1901, leg. R.A.Bastow (MEL 6950); -- Little River, [37°58'S, 144°30'E], 26.i.1897, leg. F.R.M. Wilson (NSW 180248); -- Road N from Moondarra, c. 25 km N of Moe, 38°01'S, 146°27'E, 1976, leg. G.C.Bratt 76/510 (HO); -- Dean Marsh - Lorne road, 12.x.1963, leg. G.Beaton 12 (BM); -- Lorne, [38°32'S, 143°58'E], 1890, leg. F.R.M. Wilson 1026 (type of *Lecidea ferax* Müll.Arg.) (G, NSW 155918); -- Lorne, v.1887, leg. F.R.M. Wilson (NSW 155787); -- Lorne, [no date], leg. F.R.M. Wilson (NSW 155753); -- Lorne, v.1887, leg. F.R.M. Wilson (NSW 155917); -- Lorne, v.1887, leg. F.R.M. Wilson (type of *Lecidea ferax* var.

athallina Müll.Arg., G, NSW 155924); -- 4 mi from Laver's Hill on Kennedy's Creek Road, 2.xi.1963, leg. G.Beaton 837 (BM); -- Cathedral Range, Mt Sugarloaf, c. 800 m, 12.ix.1987, leg. H.T.Lumbsch 5655 f, g (hb. Lumbsch); -- Ringwood, vii.1885, leg. F.R.M.Wilson (NSW 155889); -- Buckley Plain, Bogong Highplains, 28.i.1966, leg. A.C.Beaugehole 15797 (MEL 27890); -- About 2 mi from Laver's Hill, on Kennedy's Creek Road, 2.xi.1963, leg. G.Beaton (BM); -- Louitit-Bay, 1891, leg. J.G.Luehmann (type of *Lecidea luehmanniana* Müll.Arg., G, MEL 6937); -- Murchinson Falls Strath Creek, 6 mi E of Clonbinane, 8.xi.1963, leg. R.Filson 5211 (MEL); -- Fern Tree Gully, 23.xii.1899, leg. R.A.Bastow (MEL 6952).

Chemotype b): 2'-O-methylperlatolic acid (major):

Western Australia: John Forrest National Park, NE of Perth, 31°44'S, 116°05'E, low conglomerate boulders in sclerophyll forest, 3.iv.1986, leg. G.Rambold 5440 (M, PERTH), 5435 (M); -- Stirling Range National Park, Mt Hassell, 34°23'S, 118°04'E, sandstone rocks on summit, c. 848 m, 2.iv.1986, leg. G.Rambold 5368, 5380 (M); -- Stirling Range National Park, Baby Barnett Hill, 34°24'S, 117°48'E, low sandstone boulders on S slope of hill, 450 m, 1.iv.1986, leg. G.Rambold 5298 (M); -- Stirling Range National Park, Mondurup Peak, 34°24'S, 117°49'E, northerly exposed sandstone boulders and cliffs, c. 700 m, 2.iv.1986, leg. G.Rambold 5320, 5323, 5328, 5352, 5356 (M), 5364 (M, PERTH); -- Parkerville, 4.ix.1985, leg. E.McCrum 3, 4 (MEL).

South Australia: Mt Lofty, [35°00'S, 138°43'E], 12.ix.1887, leg. F.R.M. Wilson (NSW 155920); -- 4 km W of Carey Gully, along the Forest Range road, 456 m, 21.xii.1976, leg. J.A.Elix 2814 (ANUC).

Queensland: Thursday Island, 1887, leg. Ch.Knight (type of *Lecidea ferax* var. *geographica* Müll.Arg., G) [locality probably not correct, see p. 319]; -- Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. J.A.Elix 17300 (ANUC); -- Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. H.Streimann 30704 (CBG, H); -- C. 63 km NW of Cairns, Mt Lewis, c. 8 km WSW of Rumula and c. 3 km N of the house at the track, 16°34'S, 145°17'E, c. 950 m, 22.xi.1985, leg. G.Thor 5371 (hb. Thor); -- Herberton - Petford road, 1 km SW Herberton, 17°23'S, 145°21'E, 1000 m, 27.vi.1984, leg. J.A.Elix 16630 (ANUC); -- Seaview Range, [18°40'S, 145°45'E], 14.xi.1897, leg. F.H.Maiten (?) (NSW 155922); -- Eungella National Park, NW of Mackay, track along Broken River, 21°10'S, 148°29'E, subtropical rainforest between Broken River Camping Area and Platypus Pool, 680 m, 18.ii.1986, leg. G.Rambold 4540 (M), 4558 (BRI, M); -- Byfield, NNE from Rockhampton, 22°55'S, 150°40'E, 26.viii.1974, leg. J.M.Gilbert (HO 63767); -- Jim Crow Mtn, 25 km NE of Rockhampton, 23°13'S, 150°38'E, S exposed, partially shaded basaltic rock walls, 200 - 230 m, 14.ii.1986, leg. G.Rambold 4491 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, low boulders beside road to summit, 580 m, 13.ii.1986, leg. G.Rambold 4440 (M); -- Mt Archer, 7 km NE of Rockhampton, 23°20'S, 150°35'E, vertical and overhanging surface of E exposed rocky outcrops, 480 m, 13.ii.1986, leg. G.Rambold 4449 (M); -- D'Aguilar Range NW of Brisbane, Mt Glorious Road, at the junction with the road to Samford, 27°22'S, 152°47'E, 650 m, 1.viii.1986, leg. J. Hafellner 15847 (hb. Hafellner); -- Neranwood, 14.i.1982, leg. R.W.Rogers 2558 (BRIU).

New South Wales: Richmond Range State Forest, Toonumbar Dam, 28°37'S, 152°48'E, sandstone rock on clay road cutting, 8.ii.1986, leg. G.Rambold 4373 (M, NSW); -- By the Boyd River, Old Glen Innes Road, 3 mi E of Dalmarta, [29°52'S, 152°30'E], 30.x.1965, leg. R.Filson 7730 (MEL); -- Near Ben Lomond, 40 km S of Glen Innes, [30°02'S, 151°42'E], 1400 m, 18.viii.1976, leg. J.A.Elix 2437 (ANUC); -- Kaputar

National Park, "The Gins" 30°07'S, 150°04'E, 1100 m, 13.vii.1986, leg. P.Merriotsy 249, 268 (BRIU); -- New England National Park, Point Lookout, 30°29'S, 152°25'E, basaltic boulders in dry sclerophyll forest, c. 1563 m, 6.ii.1986, leg. G.Rambold 4317, 4318, 4327 (M); 4328 (M, MEL, NSW); -- New England National Park, Lyrebird Track, 30°30'S, 152°24'E, basaltic boulders in temperate rainforest and heath, 1300 - 1400 m, 6.ii.1986, leg. G.Rambold 4348, 4349 (M); -- 2.4 km toward Kempsey from junction of Georges Creek and Macleay River, 30°45'S, 152°13'E, 160 m, 17.v.1978, leg. B.Barnsley 203 (CBG, NICH); -- By Lake Day, Gloucester Tops, [32°00'S, 152°00'E], 26.x.1963, leg. R.Filson 5578 (MEL); -- Barrington Tops National Park, 35 km WSW of Gloucester, Gloucester River, 32°04'S, 151°39'E, 1280 m, 10.x.1978, leg. D.Verdon 3734 (CBG); -- Edgeworth, 16 km W of Newcastle, [32°56'S, 151°30'E], 26.v.1975, leg. R.Filson 15378 (MEL); -- Lithgow, [33°29'S, 150°10'E], ix.1897, leg. F.R.M.Wilson (NSW 180257); -- Du Fours Lookout, 1.5 km W of Mount Wilson, 33°30'S, 150°22'E, westerly exposed sandstone outcrops, 960 m, 2.ii.1986, leg. G.Rambold 4164, 4174, 4180 (M); -- 3 mi E of Dural, c. 15 mi NW of Sydney, [33°40'S, 151°05'E], 2.ii.1964, leg. B.Briggs L 569 (COLO L-38150); -- Blue Mountains, Springwood, c. 80 km W of Sydney, Martins Lookout to Glenbrook Creek, [33°42'S, 150°34'E], 3.x.1981, leg. H.Mayrhofer 3281, 3390 (GZU); -- Blue Mountains, Springwood, Martins Lookout to Glenbrook Creek, 33°43'S 150°33'E, on exposed sandstone rocks, 31.i.1986, leg. G.Rambold 4082 (M, NSW), 4091, 4093, 4108 (M); -- Peckmans Plateau, Katoomba, [33°43'S, 150°19'E], 980 m, 24.iv.1977, leg. J.A.Elix 3188 (ANUC); -- Blue Mountains, 3 km SE of Leura, Sublime Point Lookout, 33°44'S, 150°20'E, S facing outcrops of sandstone, 905 m, 1.ii.1986, leg. G.Rambold 4117, 4121, 4123, 4126 (M); -- Blue Mountains, "The Three Sisters", c. 1 km S of Katoomba, 33°44'S, 150°19'E, S facing sandstone cliffs between "The Three Sisters" and "Echo Point", 920 m, 1.ii.1986, leg. G.Rambold 4146 (M); -- Top of the Gib, Bowral, [34°20'S, 150°25'E], 31.viii.1907, leg. E.Cheel (NSW 155763, NSW 180241); -- Teudts Hill, 5 km SW of Bundanoon, [34°40'S, 150°15'E], 680 m, 17.ix.1980, leg. J.A.Elix 8974 (ANUC); -- Morton National Park, Coal Mine Falls, 2 km SSE of Bundanoon, 34°40'S, 150°17'E, 21.x.1984, leg. J.A.Curnow 25 (CBG); -- Southern Tablelands, Tinderry Mtns, 11 km ESE of Michelago, on road to Captains Flat, 1340 m, 3.i.1976, leg. D.Verdon 2078 (CBG, H); -- Morton National Park, 7 km NE of Nerriga, [35°05'S, 150°10'E], 760 m, 18.x.1981, leg. V.Wirth 11079 (STU); -- Morton National Park, 8 km NE of Nerriga, [35°05'S, 150°10'E], 760 m, 30.iii.1977, leg. J.A.Elix 3074 (ANUC); -- Morton National Park, Nerriga - Nowra road, 42 km NE of Ulladulla, 35°05'S, 150°07'E, 760 m, 18.x.1981, leg. H.Streimann 15738 (CBG, H, M, NY); -- Southern Tablelands, Northern Budawang Range, Quilty's Mtn, 11 km SE of Nerriga, 35°12'S, 150°11'E, 773 m, 15.viii.1976, leg. D.Verdon 2581 (CBG, M); -- Northern Budawang Range, Quilty's Mtn, 1 km SE of Nerriga, 35°12'S, 150°11'E, 773 m, 15.viii.1976, leg. D.Verdon 2581 (CBG, M); -- Slopes of Pigeon House Mtn, 19 km E of Ulladulla, 35°12'S, 150°16'E, c. 500 m, 29.ix.1977, leg. D.Verdon 3119 (CBG, M); -- Braidwood Distr., Budawang Range between Majors Creek and Araluen, [35°37'S, 149°45'E], 18.x.1967, leg. W.A.Weber & D.McVean (COLO L-49015); -- Southern Tablelands, head of Mongarlowe River, 27 km SE of Braidwood, 35°41'S, 149°54'E, 1000 m, 21.xi.1979, leg. D.Verdon 4636 (CBG, M); -- Gourcock Range, along Cowangarong Trig, track 16 km SSE of Captains Flat, 35°43'S, 149°31'E, wet sclerophyll forest with *Drimys*, on broad ridge, 1140 m, 26.i.1986, leg. G.Rambold 3957, 3963, 3972, 3975, 3981 (M), 3959 (M, NSW); -- Tinderry Range, southern foothills of Mt Tinderry, near Michelago - Captains Flat road, 10 km ESE of Michelago, 35°45'S, 149°16'E, 1260 m, 27.ix.1975, leg. D.Verdon 1833 (CBG, M); -- Tinderry Mountains, 9 km ESE of Michelago, 35°45'S, 149°16'E, exposed granite outcrops in bushland with scattered *Leptospermum*, 1200 m, 26.i.1986, leg. G.Rambold 3909 (M, NSW), 3913 (M); -- Tinderry Range, 9 km E of Michelago along the Captains Flat road, [35°53'S, 149°17'E], 1200 m, 15.xi.1981, leg. J.A.Elix 9619 (ANUC); -- Cooma, 2 km W of town, on Jindabyne road, 36°14'S, 149°07'E, large outcrops on hill, 850 m,

19.i.1986, leg. G.Rambold 3703, 3707, 3709 (M), 3712 (M, NSW); -- [no locality], 1880, leg. Ch.Knight (type of *Lecidea subpromiscua* Nyl., H-Nyl. 16851); -- Eastern Creek, 1892, leg. F.R.M.Wilson (type of *Lecidea leptoplacoides* Räs.) (H); -- Braidwood Distr., SE of Rossi, 19.xii.1967, leg. W.A.Weber & D.McVean (COLO L-49313).

A.C.T.: Western slopes of Black Mtn, Canberra, [35°17'S, 149°13'E], 760 m, 26.ix.1976, leg. J.A.Elix 2713 (ANUC); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, 1420 m, 18.xii.1985, leg. J.A.Elix 19787 (ANUC); -- Blue Range, 24 km WNW of Canberra, 35°18'S, 149°51'E, 1100 m, 25.iv.1980, leg. H.Streimann 10194 (CBG, H, M); -- Along Kangaroo Creek near Corin Dam, [35°32'S, 148°50'E], 25.xi.1975, leg. J.A.Elix 1367 (MEL); -- Booroomba Rocks, 30 km SSE of Canberra, 35°32'S, 149°00'E, 1240 m, 11.vii.1979, leg. H.Streimann 9059 (CBG); -- Booroomba Rocks, 1 km SW of Tharwa, [35°37'S, 149°04'E], 1360 m, 11.vii.1979, leg. J.A.Elix 6172 (ANUC); -- Naas Creek, 57 km S of Canberra, 35°49'S, 148°56'E, 1677 m, 18.viii.1975, leg. D.Verdon 1691 (CBG), 1684 (CBG, M).

Victoria: Along the Cann River, 25 km N of Cann River township, 23.xi.1978, leg. J.A.Elix 5382 (ANUC); -- 1.5 mi S of Mitta Mitta, [36°32'S, 147°22'E], c. 1000 ft, 18.xi.1964, leg. J.H.Willis (MEL 1018465); -- 8 mi NNW of Rheola, [36°39'S, 143°42'E], 1.xi.1964, leg. R.Filson 6618 (MEL); -- On road from Omeo to Corroyong, c. 10 km S of Sassafras Gap (75 km S of Corroyong), 36°39'S, 147°42'E, c. 800 m, 28.ii.1985, leg. H.Hertel 31593, 31594 (M); -- Great Dividing Range, Mt Wombargo near Rocky Plain, 36°56'S, 148°12'E, c. 1400 m, 27.ii.1985, leg. H.Hertel 31530 (M); -- Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3333 (M); -- 16 km SE of Wulgulmerang, 37°09'S, 148°25'E, small boulders in tall open *Eucalyptus* forest along Deddick Track (S of Bowen Track), 800 - 900 m, 12.i.1986, leg. G.Rambold 3362 (M); -- 6 km SSW of Talbot, 37°14'S, 143°41'E, c. 320 m, 19.v.1977, leg. T.B.Muir 5487 (MEL); -- Gippsland, Bondi State Forest, along Cann River Valley Hwy, 45 km S of Bombala, 37°15'S, 149°15'E, 360 m, 23.xi.1978, leg. D.Verdon 4351 (CBG, M); -- Kilmore, [37°18'S, 144°57'E], 31.viii.1885, leg. F.R.M.Wilson (NSW 180240); -- Hanging Rock, 7 km NE of Woodend, 37°20'S, 144°36'E, 20.viii.1981, leg. M.& H. Mayrhofer 3078 (GZU); -- Daylesford, [37°21'S, 144°09'E], x.1944, leg. C.French (MEL 7247); -- Mt Macedon, [37°23'S, 144°37'E], ii.1890, leg. F.R.M.Wilson (NSW 180233); -- Grubb Gully, Creswick, [37°26'S, 143°54'E], 19.i.1963, leg. J.H.Willis (MEL 1031124); -- Mt Blackwood, NW slopes overlooking Cerderdarg (?) Gorge, [37°30'S, 144°23'E], 26.ii.1966, leg. J.H.Willis (MEL 1030583); -- Dead end track off Eagles Nest Road, Strathewen, c. 2.5 km from Strathewen bridge, [37°33'S, 145°16'E], 21.x.1984, leg. R.A.Kilgour 465 (MEL); -- Blackspur, [37°36'S, 145°37'E], 11.xi.1900, leg. R.A.Bastow (MEL 6980); -- Mt Abrupt, [37°36'S, 142°22'E], 13.xi.1896, leg. F.R.M.Wilson (NSW 155811); -- Mt Donna Buang, [37°42'S, 145°41'E], iii.1963, leg. P.W.James (BM); -- Lilydale, [37°46'S, 145°21'E], 7.iii.1898, leg. F.R.M.Wilson (NSW 155826); -- Kew, Yarra Boulevard, below Kew Mental Asylum, 37°48'S, 145°01'E, 40 m, 16.iv.1986, leg. G.Rambold 5590 (M); -- Melbourne, Yarra Bend, [37°50'S, 145°00'E], 18.xi.1899, leg. R.A.Bastow (MEL 6981); -- Little River, [37°58'S, 144°30'E], iv.1887, leg. F.R.M.Wilson (NSW 155793); -- Little River, 26.i.1897, leg. F.R.M.Wilson (NSW 169074); -- Kilmore, [38°07'S, 146°54'E], iv.1890, leg. F.R.M.Wilson (NSW 155909); -- Aringa Reservoir, 8 km N of Port Fairy, 38°23'S, 142°14'E, 28.ii.1972, leg. P.Holbeach (HO 63728); -- Erskine River Lorne, [38°32'S, 143°58'E], 4.ii.1886, leg. F.R.M.Wilson (NSW 155771); -- Murchinson Falls, Strath Creek, 6 mi E of Clonbinane, 8.ix.1963, leg. R.Filson 5210 (MEL).

Poeltiaria Hertel

HERTEL, Beih. Nova Hedwigia **79**: 430 (1984).

Typus generis: *P. turgescens* (Koerb.) Hertel - (holotype).

The species of *Poeltiaria* are distributed in cold to warm temperate, humid regions of the Southern Hemisphere (Subantarctic Islands, South America, South Africa, southern Australasia).

The most striking character, which unites all species of this genus, is an unpigmented hypothecium. Like in *Porpidia*, all species have more or less halonate spores. The form and length of the conidia, however, differ within *Poeltiaria*. *P. turgescens* and *P. coromandelica* have filiform conidia like the species of *Paraporpidia*, while *P. corralensis* and *P. urbanskyana* have cylindrical ones like the species of *Porpidia* (fig. 23). *Poeltiaria urbanskyana* (Zahlbr.) Hertel, which has been combined in *Porpidia* by BRUSSE (1988a: 94), is restricted to the Subantarctic Islands and is not dealt with here.

Given the exclusively Southern Hemisphere distribution of this genus, the ecological requirements of the three species occurring in Australia (restricted to subhumid situations and mostly growing in rainforest areas) and the development of filiform conidia in some species, a separation of this genus from *Porpidia* appears justified. BRUSSE (l.c.) rejected the genus *Poeltiaria*, regarding the lack of pigmentation of the hypothecium as not being a significant character. For the generic delimitation against *Paraporpidia*, see notes under the latter.

Poeltiaria coromandelica (Zahlbr.) Rambold & Hertel comb. nov.

= *Lecidea coromandelica* Zahlbr., Kaiserl. Akad. Wiss. Wien, Math.-Naturwiss. Kl., Denkschr. **104**: 311 (1941); LAMB, Index Nom. Lich.: 346 (1963); SCHNEIDER, Biblioth. Lich. **13**: 238 (1980); GALLOWAY, Fl. New Zeal. Lich.: 229 (1985); HERTEL, Mitt. Bot. Staatssamml. München **21**: 322 - 323 (1985); Mitt. Bot. Staatssamml. München **23**: 326 (1987).

Type: NEW ZEALAND: South Auckland: Coromandel Peninsula, Mt Moehau, c. 850 m, on rocks near summit, leg. L.M.Cranwell ZA 626 (W, holotype) - [fide GALLOWAY 1985].

DESCRIPTION:

Thallus: areolate, up to 50 mm diam., up to 1.5 mm thick.

AREOLES: angular, yellow, plane to subconvex, with smooth to rough surface, c. 1.4 - 2 mm, max. 3 mm diam. Cortex 35 - 70 μ m thick; upper cell layer colourless, yellow-grey incrustated with lichen substances (usnic acid); hyphae c. 3 - 4 μ m diam.; epinecral layer not developed. Algal layer c. 50 - 100 μ m thick; algal cells c. 10 - 11 μ m, max. 13 - 15 μ m diam. Medulla $\pm$ pale blue to violet; hyphae 3 - 4 μ m thick.

HYPOTHALLUS: grey, obvious at the margin of the areoles or not developed.

Apothecia: irregularly roundish, mostly crowded, 40 - 80/cm², sessile, more or less constricted at the base, c. 0.6 - 1.1 mm, max. 1.2 - 1.9 mm diam. Disc plane to subconvex, black, matt, epruinose. Margin at first distinct, later more or less persistent, black, matt to subnitid.

EXCIPULUM: max. 90 - 180 μ m, lateral of hymenium 70 - 160 μ m thick. Ectal zone black; pigmented zone 50 - 60 μ m tall; hyphae 4 - 4.5 μ m diam., with lumina of 1 μ m. Inner zone brown; hyphae 3 - 5.5 μ m diam., with lumina of 1 - 1.5 μ m. Medullary zone not obvious.

HYPOTHECIUM: colourless, hyphae 2.5 - 3 μ m diam.; subhymenial layer colourless.

HYMENIUM: 55 - 80 μ m tall, colourless, I+ blue, Iconc. - . Epihymenium green-grey to black-green, 10 - 15 μ m tall. Paraphyses more or less branched and anastomosing, 1.5 - 2 μ m, apices 3.5 - 4 μ m thick. Asci c. 60 x 11 - 15 μ m; tholus max. 10 - 14 μ m, min. 5 - 6 μ m thick; amyloid tube c. 3 μ m broad; outer amyloid wall layer 1.3 μ m thick, I+ blue, Iconc.+ blue-brown; non-amyloid wall layer c. 0.2 μ m thick. Spores ellipsoid, 10 - 16 x 5 - 7 μ m.

Pycnidia: immersed. Conidia filiform, 19 - 20.5 - 25 x 1 μ m.

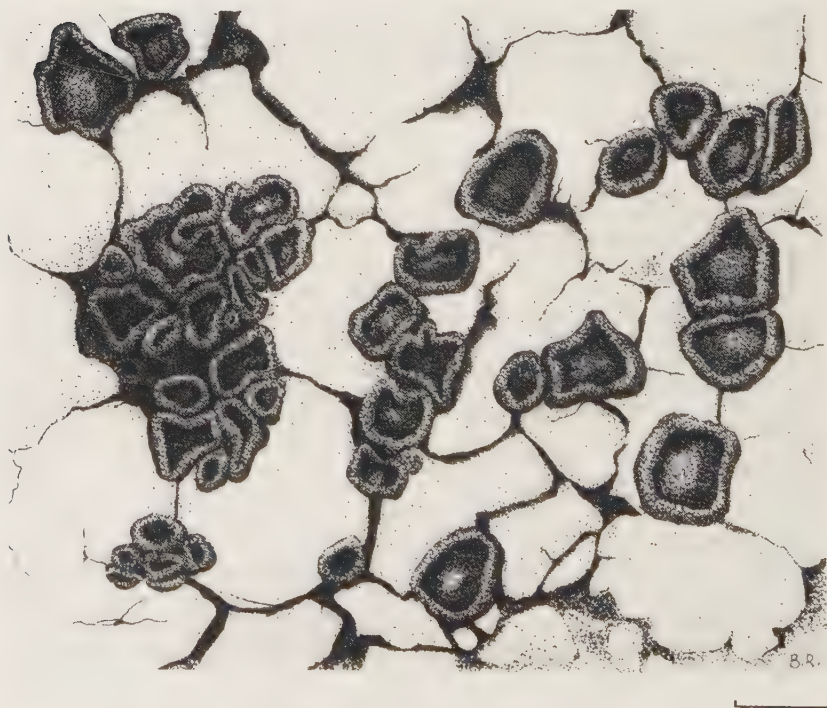


Fig. 26. *Poeltiaria coromandelica*. (GR 3337, M) Scale = 1 mm.

CHEMISTRY:

Cortex K+ yellow, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-. One chemotype observed, containing usnic acid (13 specimens examined). (Traces of confluent acid or 2'-O-methylperlatolic acid, occasionally found in *P. coromandelica*, probably derive from overgrown thalli of other lichen species, e.g. of *P. leptocarpa*).

DISTRIBUTION:

Australasian. New to continental Australia! *P. coromandelica* is known from New Zealand (GALLOWAY 1985, HERTEL 1985), Tasmania (HERTEL 1987b) and occurs within continental Australia in N.S.W. and Vic. (map 50). The species grows on siliceous boulders in semi-exposed to exposed position.



Map 50. Distribution of *Poeltiaria coromandelica* in continental Australia

NOTES:

P. coromandelica is one of the most conspicuous and typical lecideoid species occurring in Australia. By its vivid yellow thallus and the black apothecia, it closely resembles certain species of *Rhizocarpon*. The colour is caused by the presence of usnic acid. *P. coromandelica* is the only representative of the Porpidiaceae, which contains this substance. Among the genera comprising lecideoid species, usnic acid is also known from species of the Lecanoraceae (incl. Tephromelataceae) and from two species of the Psoraceae *Chrysopsora testacea* (Hoffm.) Choisy (SANTESSON 1969) and *Psora rubiformis* (Ach.) Hook. and (SCHNEIDER 1980, TIMDAL 1987a) as yet. *Poeltiaria coromandelica* is a facultative juvenile parasite of *Paraporpidia leptocarpa*.

SPECIMENS EXAMINED:

New South Wales: New England National Park, Lyrebird Track, 30°30'S, 152°24'E, basaltic boulders in heath, 1300 - 1400 m, 6.ii.1986, leg. G.Rambold 4355, 4362 (M).

Victoria: Little River Falls, 5 km NE of Wulgulmerang, 37°04'S, 148°19'E, rocky outcrops beside stream, c. 800 m, 11.i.1986, leg. G.Rambold 3310, 3337 (M), 3334 (M, MEL); -- Southern end Cross Cut Saw, 14.ii.1967, leg. R.Filson 9763 (MEL); -- Great Dividing Range, Hanging Rock E of Woodend, c. 70 km NE of Melbourne, 37°22'S, 144°40'E, c. 500 m, 18.vii.1986, leg. J.Hafellner 15758 (hb. Hafellner); -- Camels Hump, Mt Macedon, [37°22'S, 144°37'E], 7.iii.1970, leg. R.Filson 11553 (MEL); -- Cathedral Range, Buxton, Sugarloaf Peak, 37°24'S, 145°45'E, 11.x.1981, leg. V.Wirth 10730, 10731, 11250 (STU); -- Kew (?), [37°48'S, 145°01'E], [no date], leg. F.R.M.Wilson (NSW 180253).

Poeltiaria corralensis (Räs.) Hertel

HERTEL, Beih. Nova Hedwigia **79**: 431 (1984); Mitt. Bot. Staatssamml. München **21**: 310 - 312 (1985); Mitt. Bot. Staatssamml. München **23**: 330 (1987).

= *Lecidea corralensis* Räs., Revista Univ. (Santiago de Chile) **22**: 211 (1937); LAMB, Index Nom. Lich.: 346 (1963); HERTEL, Herzogia **2**: 40 (1970).

Type: CHILE: Prov. Valdivia, Mal Paso (Corral), 30 m, 10.iii.1935, leg. H.Gunckel 5158 (H!, holotype) - [no substances detected].

DESCRIPTION:

Thallus: rimose, up to 90 mm diam., 0.1 - 0.5 mm thick.

AREOLES: irregularly shaped, whitish to creamy coloured, plane, with mostly smooth surface, c. 0.6 - 0.8 mm, max. 1.3 - 1.5 mm diam. Cortex 10 - 35 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer not developed. Algal layer c. 60 - 100 µm thick; algal cells c. 9 - 10 µm, max. 11 - 12 µm diam. Medulla I - or pale blue to violet; hyphae 2.5 - 3.5 µm thick.

HYPOTHALLUS: greyish, obvious at the thallus margin, mostly not developed.

Apothecia: round, dispersed, 15 - 30/cm², sessile, constricted at the base, c. 1 - 1.1 mm, max. 1.2 - 2.1 mm diam. Disc plane to subconvex, black, matt, epruinose. Margin at first distinct, later vanishing, black, matt.

EXCIPULUM: max. 180 - 280 μ m, lateral of hymenium 120 - 200 μ m thick. Ectal zone olivaceous to blue-green; pigmented zone 15 - 20 μ m tall; hyphae 3 - 5 (- 6) μ m diam., with lumina of 1 - 2 μ m. Inner zone colourless; hyphae 4.5 - 5 μ m diam., with lumina of 1 - 2 μ m. Medullary zone not developed.

HYPOTHECIUM: colourless or occasionally incrustated with lichen substances (porphyritic acid ?), hyphae 2.5 μ m diam.; subhymenial layer colourless.

HYMENIUM: 75 - 110 μ m tall, colourless, I+ blue, Iconc. $\pm$ blue or -. Epithymenium olivaceous, c. 15 μ m tall. Paraphyses more or less branched and anastomosing, 1 - 1.5 μ m, apices 3 - 4 μ m thick. Asci c. 70 - 90 x 13.5 - 18 μ m; tholus max. 15 μ m, min. 10 μ m thick; amyloid tube

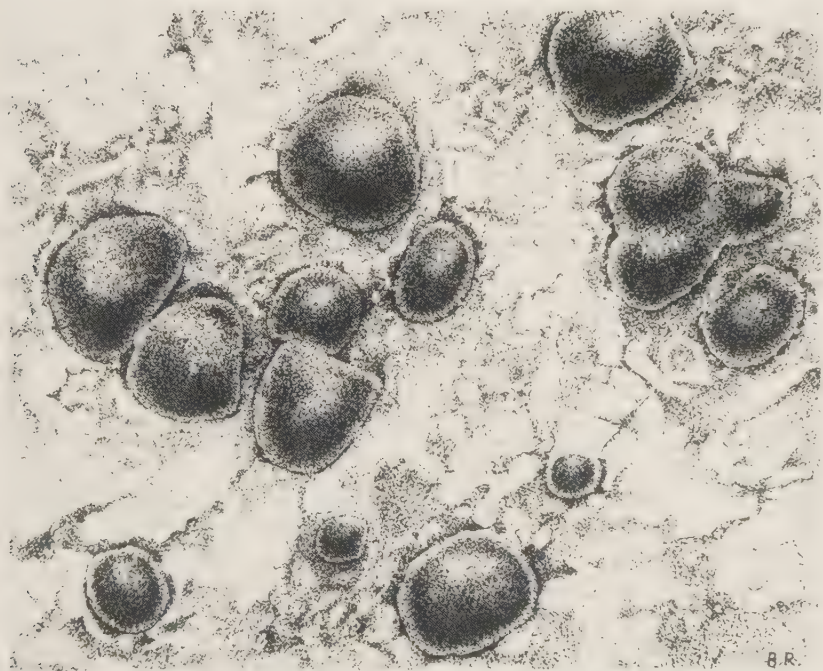


Fig. 27. *Poeltiaria corralensis*. (GR 3244, M) Scale = 1 mm.

c. 4 - 6 μm broad; outer amyloid wall layer 0.5 μm thick, I $\pm$ blue, I conc. + bluish-brown; non-amyloid wall layer 0.2 μm thick. Spores ellipsoid, 13 - 21 x 6.5 - 10 μm .

Pycnidia: immersed. Conidia cylindrical, 8 - 9 - 11 x 0.8 - 1 μm .

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

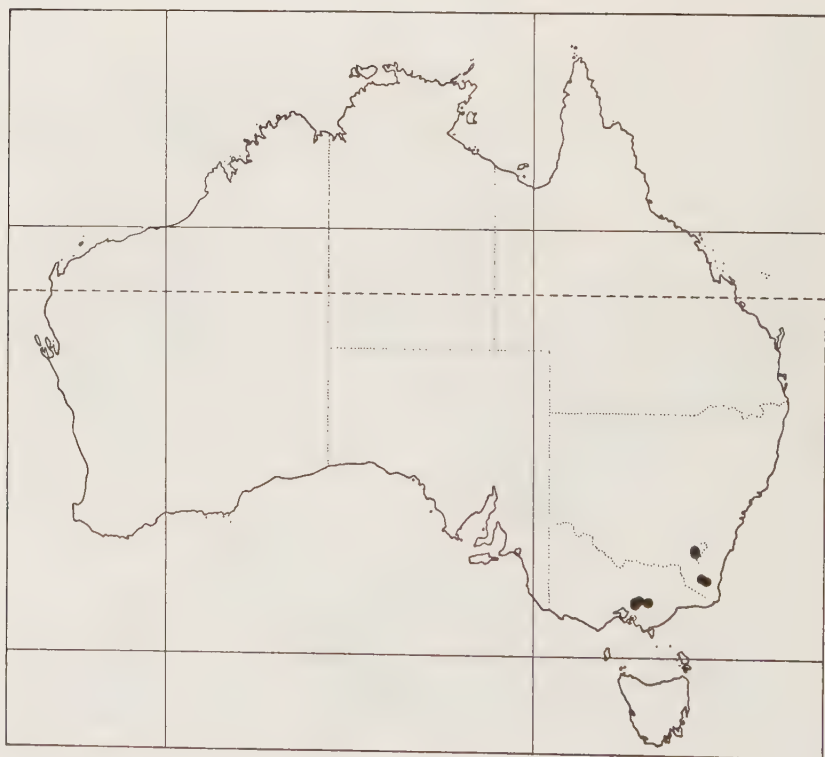
Two chemotypes observed:

a) containing porphyrylic acid (3 specimens examined);

b) containing no detectable lichen substances (9 specimens examined).

DISTRIBUTION:

Austral. New to continental Australia! *P. corralensis* is known from South America (Chile and Argentina), from New Zealand (South Island), Tasmania (HERTEL 1985, 1987b), and South Africa (HAIDUK



Map 51. Distribution of *Poeltiaria corralensis* in continental Australia

unpubl.). Within continental Australia, the species is distributed in N.S.W., A.C.T. and Vic. (map 51), growing on siliceous rocks, usually in semi-closed forests. In comparison with *P. turgescens*, *P. corralensis* has a more southern distribution in Australia, similar to its occurrence in New Zealand as shown in HERTEL (1985: 311, fig. 3).

NOTES:

P. corralensis is well defined by a colourless hypothecium, a I + bluish medulla, a greenish ephymenium and the production of porphyritic acid or the lack of lichen substances, respectively. The two chemical strains are distinguished neither by anatomical nor by ecological differences. A similar species, *P. turgescens*, differs in its chemistry (confluent acid) and in the brownish colour of the ephymenium. In contrast to *P. turgescens* and *P. coromandelica*, *P. corralensis* and the subantarctic species *P. urbanskyana* develop cylindrical conidia.

Lecidea howickensis Vain.¹⁾, described from South Africa, is probably an older name for *P. corralensis*. This taxon has an unpigmented excipulum and lacks lichen substances, as does one strain of *P. corralensis*. The marginal pigmentation of the excipulum and the ephymenium, however, is more brownish. It therefore remains unclear whether *P. corralensis* will fall into the synonymy of *P. howickensis*, or whether it represents a separate species. The possibility, that *L. howickensis* is a synonym of *P. turgescens* can be excluded, as there are no South African collections of *P. turgescens*, and lichen acid-deficient specimens of *P. turgescens* are not known.

SPECIMENS EXAMINED:

New South Wales: 1 km N of Pipers Lookout, Brown Mtn, 17 SE of Nimmitabel, [36°31'S, 149°17'E], 920 m, 18.ii.1982, leg. J.A.Elix 9666 (ANUC); -- Rutherford Creek, 11 km SE of Nimmitabel, 36°34'S, 149°36'E, 850 m, 19.ii.1982, leg. H.Streimann 16717 (CBG, H).

A.C.T.: Brindabella Range, Mt Franklin Road, 31.5 km SW of Canberra, 35°23'S, 148°48'E, 1220 m, 12.iii.1975, leg. D.Verdon 997 (CBG); -- Brindabella Range, Aggie Gap, 43 km WSW of Canberra, [35°30'S, 148°47'E], 1400 m, 14.xi.1981, leg. J.A.Elix 9535 (ANUC).

Victoria: Lake Mountain road, 12 km E of Marysville, c. 4 km S of Gerrattys, 37°30'S, 145°53'E, 17.x.1981, leg. H.Mayrhofer 2963 (GZU); -- Buxton, Mt Margaret saddle, 37°35'S, 145°42'E, 11.x.1981, leg. V.Wirth 10742 (STU); -- Baw Baw National Park, 6 km SE of Mt Erica, 37°35'S, 146°23'E, on clay road cutting on Mt Erica Road, 900 - 1000 m, 10.i.1986, leg. G.Rambold 3244 (M), 3247 (M, MEL); -- Mt Donna Buang, [37°42'S, 145°41'E], 16.iv.1963, leg. S.L.Thrower 792 (BM); -- Cement Creek, 24.iii.1963, leg. S.L.Thrower 760, 784 (BM).

1) *Poeltiaria howickensis* (Vain.) Rambold & Haiduk comb. nov. = *Lecidea howickensis* Vain., Ann. Univ. Fennic., Aboens. ser A, 2 (3): 24 (1926). - Type: REP. SOUTH AFRICA: Natal, Howick, 1920, leg. v.d.Byl (TUR 34.0061, holotype).

***Poeltiaria turgescens* (Koerb.) Hertel**

HERTEL, Beih. Nova Hedwigia **79**: 431-432 (1984); Mitt. Bot. Staats-samml. München **21**: 311, 326 (1985); FILSON, Checklist Austr. Lich. 3. ed.: 20, 155 (1988).

≡ *Lecidella turgescens* Koerb., Abh. Schles. Ges. Vaterl. Cult., Abth. Naturwiss. **2**: 34 (1862); FILSON, Checklist Austr. Lich. 1. ed.: 51 (1983); Checklist Austr. Lich. 2. ed.: 65 (1986); Austr. Fl. Fauna Ser. **4**: 133 (1986).

≡ *Porpidia turgescens* (Koerb.) Brusse, Bothalia **18**: 94 (1988).

≡ *Lecidea turgens* Nyl. ex Hue (nomen novum et illegit.), Nouv. Archiv. Mus. ser. 3, **3**: 133 (1891); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 713 no. 6826 (1925); WEBER & WETMORE, Beih. Nova Hedwigia **41**: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 51 (1983); Checklist Austr. Lich. 2. ed.: 64 (1986); Austr. Fl. Fauna Ser. **4**: 132 (1986).

Type: AUSTRALIA: [no locality, no date], "Ad saxa arenaria Nov. Hollandiae missit beat. Hochstetter" (L 910. 188-1854, holotype - according to FILSON (1986b: 133); M!, H-Nyl. 5129!, iso-types) - [containing confluent acid (major), 2'-O-methylperlatolic acid (minor)].

DESCRIPTION:

Thallus: rimose, verrucose, up to 130 mm diam., 0.1 mm thick.

AREOLES: creamy white, plane, mostly with smooth surface. Cortex 20 - 30 µm thick; upper cell layer not pigmented; epinecral layer not developed. Algal cells c. 8 - 9 µm, max. 10 µm diam. Medulla I -; hyphae 3.5 - 4 µm thick.

HYPOTHALLUS: grey, obvious at the thallus margin, mostly not developed.

Apothecia: round to roundish, occasionally auriculate, dispersed, 15 - 80/cm², sessile, constricted at the base, c. 1 - 1.4 mm, max. 3.5 - 4 mm diam. Disc plane, black-brown, matt, ± pruinose (rarely rusty coloured). Margin at first distinct, later persistent, black, matt.

EXCIPULUM: max. 170 - 250 µm, lateral of hymenium 70 - 180 µm thick. Ectal zone brown to black-brown; pigmented zone 15 - 25 µm tall; hyphae 2.5 - 3.5 (- 4) µm diam., with lumina of 1 µm. Inner zone greyish incrustated with lichen substances (confluent acid); hyphae (2.5 -) 3 - 5 µm diam., with lumina of 1 - 2 µm. Medullary zone not developed.

HYPOTHECIUM: colourless to pale brownish, 200 - 300 µm thick; hyphae 3 - 4.5 µm diam.; subhymenial layer colourless.

HYMENIUM: 80 - 130 µm tall, colourless, I+ blue, I_{conc.}+ blue. Epihymenium brown to brownish, 12 - 15 µm tall. Paraphyses more or less branched and anastomosing, 1.2 - 1.8 µm, apices 2.5 - 3.5 µm thick. Asci c. 75 - 85 x 12 - 14 µm; tholus max. 8 - 18 µm, min. 4 - 9 µm thick; outer amyloid wall layer 0.5 - 1 (- 2.5) µm thick, I+ blue, I_{conc.}+ blue-brown; non-amyloid wall layer 0.5 - 1 µm thick; amyloid tube 4 - 8 µm broad. Spores ellipsoid, 13.5 - 20 x 6 - 8 µm.

Pycnidia: immersed. Conidia filiform, 16 - 18 - 20 x 0.8 - 1 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing confluent acid (major), 2'-O-methylperlatolic acid, 2'-O-methylmicrophyllinic acid (15 specimens examined).

DISTRIBUTION:

Australasian. This species was described from N.S.W. and is known from New Zealand (Three Kings Island, North Island and the northern part of South Island) (HERTEL 1985: 311, fig. 3). Within continental Australia, it occurs in Qld, N.S.W. and Vic. (map 52), growing on siliceous boulders, mainly in rainforest areas. The report from S.A. should be regarded with reservation.

NOTES:

P. turgescens is well separated from *P. corralensis* by its chemistry and the different pigmentation of the excipulum and epihymenium. As



Map 52. Distribution of *Poeltiaria turgescens* in continental Australia

with *P. leptocarpa*, the discs of the apothecia are occasionally rusty coloured due to depositions of iron oxide containing particles.

SPECIMENS EXAMINED:

South Australia: Dublin, 34°27'S, 138°21'E, 31.iii.1975, leg. B.Whitehead (HO 51851).

Queensland: Crystal Creek National Park, Paluma, 19°00'S, 146°13'E, tropical rainforest between Paluma and Witt's Lookout, c. 900 m, 25.ii.1986, leg. G. Rambold 4783 (M); -- D'Aguilar Range NW of Brisbane, Mt Glorious Road, at junction with the road to Samford, 27°22'S, 152°47'E, 650 m, 1.viii.1986, leg. J.Hafellner 15846 (hb. Hafellner); -- Neranwood, 14.i.1982, leg. R.W.Rogers 2555 (BRIU).

New South Wales: North Coast, below Waihou Trig Station, 25 km NW of Coffs Harbour, 30°06'S, 153°02'E, 340 m, 12.x.1978, leg. D.Verdon 3800, 3821 (CBG, M); -- New England National Park, Lyrebird Track, 30°30'S, 152°24'E, basaltic boulders in temperate rainforest, 1300 - 1400 m, 6.ii.1986, leg. G.Rambold 4354, 4357 (M), 4356 (M, NSW); -- Barrington Tops National Park, Gloucester Tops, Negrohead Beech Forest Walking Trail, 32°05'S, 151°35'E, mossy low boulders in temperate rainforest with *Nothofagus*, c. 1200 m, 4.ii.1986, leg. G.Rambold 4240 (M); -- Blue Mountains, 4 km SE of Blackheath, walking track from Neates Glen via Grand Canyon to Evans Lookout, [33°40'S, 150°18'E], 900 - 1000 m, 3.i.1985, leg. H.Mayrhofer 6694 (GZU); -- Blue Mountains, track by side of Sassafras Creek, c. 2 km SSW of Springwood, 33°43'S, 150°34'E, c. 250 m, 5.viii.1988, leg. H.Mayrhofer 7899 (GZU, hb. Mayrhofer); -- Tianjara Falls, Tianjara Creek, 30 km NW of Ulladulla, 35°08'S, 150°20'E, 350 m, 21.vi.1979, leg. H.Streimann 7848 (CBG); -- Pinkwood Forest Reserve, 25 km SW of Moruya, 36°00'S, 149°52'E, 380 m, 26.xi.1981, leg. H.Streimann 1577 (CBG, H); -- Belmore Falls, ix.1907, leg. E.Cheel (NSW L-3607).

[no locality, no date], "comm. Hochstetter" (type of *Lecidella turges-cens* Koerb., M, H-Nyl. 5129).

Poeltidea Hertel & Hafellner in Hertel

HERTEL, Beih. Nova Hedwigia **79**: 462-463 (1984).

Typus generis: *P. perusta* (Nyl.) Hertel & Hafellner - (holotype).

Poeltidea is a monotypic genus, occurring in the alpine regions of Australasia, in the southernmost South America (Terra del Fuego) and on the Subantarctic Islands. The genus seems to be relatively isolated within the Porpidiaceae by its very large spores, which become greenish-brownish coloured during maturation. Affinities probably exist with *Bellemerea*, *Immersaria* and *Koerberiella*. *Immersaria* and *Bellemerea* resemble *Poeltidea* in its immersed apothecia and the occurrence of a nitid brown thallus. However, these genera have an I+ orange-red hymenium and constantly colourless spores. In *Bellemerea* however, the spore walls usually show a striking I+ violet reaction. With *Koerberiella*, *Poeltidea* shares the large spores and asci and a I± bluish amyloid reaction of the hymenium. However the spores of the lecanoroid genus *Koerberiella* are constantly colourless.

Poeltidea perusta (Nyl.) Hertel & Hafellner in Hertel

HERTEL, Beih. Nova Hedwigia **79**: 463 (1984); Mitt. Bot. Staatsamml. München **23**: 330 - 331 (1987).

= *Lecidea perusta* Nyl. in Cromb., J. Bot. **13**: 334 (1875); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 584 (1925) - sub *Lecidea fuscoatra*.

= *Mykoblastus perustus* (Nyl.) Dodge, B.A.N.Z.A.R.E. Rep. Ser. B, **7**: 102 - 103 (1948).

Type: KERGUELEN: Royal Sound, ii.1875, leg. A.E.Eaton (Venus Transit Expedition) (BM!), lectotype - designated in HERTEL 1984).

DESCRIPTION:

Thallus: areolate, up to 85 mm diam., 0.15 - 0.7 mm thick.

AREOLES: angular, brown, $\pm$ plane, with smooth surface, c. 0.5 - 0.7 mm, max. 0.7 - 1.5 mm diam. Cortex 30 - 55 μ m thick; upper cell layer brown pigmented; hyphae c. 4 μ m diam.; epinecral layer 15 - 55 μ m thick. Algal layer c. 55 - 80 μ m thick; algal cells c. 10 μ m, max. 13 - 16 μ m diam. Medulla I -; hyphae brown to dark brown, c. 4 μ m thick.

HYPOTHALLUS: black, obvious between the areoles and at the thallus margin.

Apothecia: angular to roundish, crowded to dispersed, 10 - 40/cm², completely immersed, c. 1.0 - 1.4 mm, max. 1.3 - 2.0 mm diam. Disc mostly plane, dark brown, mostly epruinose. Margin not developed.

EXCIPULUM: not developed.

HYPOTHECIUM: colourless, hyphae 2.5 - 3 μ m diam.; subhymenial layer colourless.

HYMENIUM: 100 - 120 μ m tall, colourless, I+ blue, I conc. $\pm$ bluish. Epihymenium brown, 15 - 18 μ m tall, with gelatinous layer of 15 - 30 μ m above. Paraphyses branched and anastomosing, 1.5 - 2 μ m, apices 3 - 4 μ m thick. Asci c. 95 x 50 μ m; tholus max. c. 30 μ m, min. c. 15 μ m thick; amyloid tube up to c. 6 μ m broad; outer amyloid wall layer c. 1 μ m thick, I+ blue, I conc. $\pm$ blue; non-amyloid wall layer c. 1 μ m thick. Spores ellipsoid, first colourless, later greenish-brown to dark brown, 27 - 39 x 14 - 17 μ m.

Pycnidia: immersed. Conidia cylindrical, 4 - 5.4 - 6 x 1 - 1.5 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing no detectable lichen substances (4 specimens examined).

DISTRIBUTION:

Austral. New to Australia! The species was hitherto known from the Kerguelen Islands, South Georgia, New Zealand (South Island) and from Argentina (Patagonia) (HERTEL 1987b) but is now also reported for continental Australia, where it occurs in the alpine zone of the Snowy Mountains (N.S.W.) (map 53), growing on siliceous rocks.

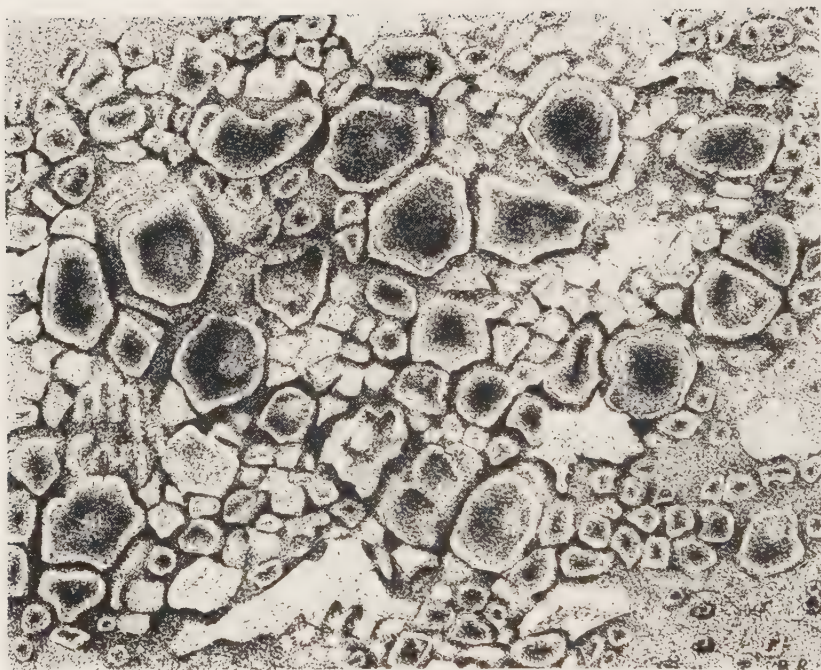


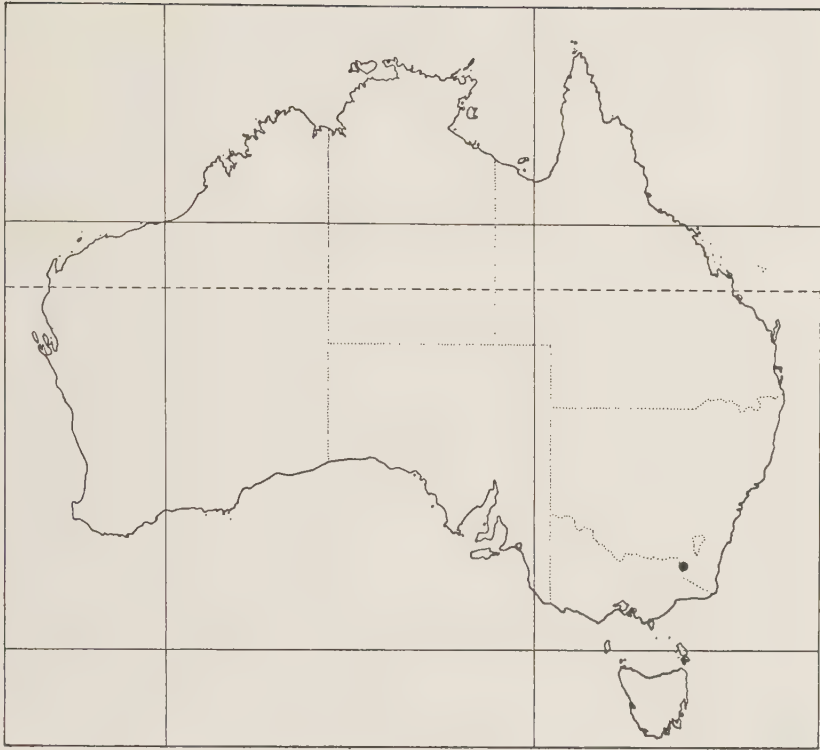
Fig. 28. *Poeltidea perusta*. (GR 3426, M) Scale = 1 mm

NOTES:

P. perusta is well defined by its brown nitid thallus, immersed apothecia and relatively large, halonate spores, which become greenish-brownish during maturation. The fact that the fertile areoles are elevated above the level of the surfaces of the sterile areoles is characteristic for this species. The apothecia are, so to speak, marginate by an areole (fig. 28). This type of "margination" is intermediate between the "aspicilioid" type and the "lecanorine" type.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31756 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3425, 3426 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3529, 3551 (M, NSW).



Map 53. Distribution of *Poeltidea perusta* in continental Australia

***Porpidia* Koerb.**

KOERBER, Syst. Lich. Germaniae: 221 (1855); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 498 - 499 (1925); HERTEL, Beih. Nova Hedwigia 79: 432 - 433 (1984); GOWAN, Bryologist 92: 33 - 34 (1989).
 Typus generis: *Porpidia trullisata* (Kremp.) Koerb - (holotype).

= *Haplocarpon* Choisy in Tronchet

TRONCHET, Bull. Mens. Soc. Linn. Lyon 5: 21 (1936).

= *Lecidea* subg. *Haplocarpon* (Choisy) Hertel, Beih. Nova Hedwigia 24: 63 (1967).

Typus generis: *Haplocarpon macrocarpum* (DC.) Choisy - (lectotype - designated in HERTEL 1967).

This study follows the concept of *Porpidia* enunciated in HERTEL (1984). The species included in this genus are characterized by sessile to subimmersed apothecia, a pigmented hypothecium, halonate spores, an Iconc. + blue to bluish hymenium and by the lack of cephalodia. The main diagnostic features of the species of *Porpidia* occurring in Australia and other related genera are given in table 12 and 13. The differences between this genus and *Farnoldia*, containing species with a similar combination of characters but not known from Australia, will be discussed in detail by PIETSCHMANN (in prep.).

***Porpidia albocaerulescens* (Wulfen) Hertel & Knoph in Hertel**

HERTEL, Beih. Nova Hedwigia **79**: 433 - 434 (1984); HERTEL & KNOPH, Mitt. Bot. Staatssamml. München **20**: 467 - 488 (1984); HERTEL, Mitt. Bot. Staatssamml. München **21**: 327 - 329 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 120 (1986); HERTEL, Mitt. Bot. Staatssamml. München **23**: 331 - 332 (1987); FILSON, Checklist Austr. Lich. 3. ed.: 20, 157 (1988); GOWAN, Bryologist **92**: 35 - 38 (1989).

≡ *Lichen albocaerulescens* Wulfen in Jacquin ("*Lichen albo-caerulescens*"), Collect. Bot. (tab. XV, fig. 1) **2**: 184-185 (1788).

≡ *Lecidea albocaerulescens* (Wulfen) Ach., Method. Lich. : 52 (1803); MÜLLER ARGOVIENSIS, Nuovo Giorn. Bot. Ital. **23** (3): 391 (1891); Bull. Herb. Boissier **1** (2): 46 - 47 (1893); SHIRLEY in BAILEY, Queensl. Dept. Agric. Brisbane Bot. Bull. **8**: 99 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 504 - 507 no. 6268 (1925); **8**: 330 (1932); **10**: 296 - 297 (1940); WEBER & WETMORE, Beih. Nova Hedwigia **41**: 50 (1972).

≡ *Biatora albocaerulescens* (Wulfen) Hepp, Flecht. Eur. no. 126: fig. B (1853).

≡ *Haplocarpon albocaerulescens* (Wulfen) Choisy, Bull. Mens. Soc. Linn. Lyon **19**: 159 (1950).

≡ *Huillia albocaerulescens* (Wulfen) Hertel, Herzogia **3**: 373 (1975); GALLOWAY, Fl. New Zeal. Lich.: 186 (1985).

var. *albocaerulescens*

Type: AUSTRIA: Kärnten, Kreuzberg oberhalb Ziguln bei Klagenfurt, ca. 500 m, 29.vii.1881, leg. F. Arnold - Arnold, Lich. Exs. 894 (M!), neotype - designated in HERTEL 1977, isoneotype - [containing stictic acid (major), norstictic acid (trace)].

= *Lecidea subnubila* Stirt.

STIRTON, Trans. & Proc. Roy. Soc. Victoria **17**: 71 (1881); KNIGHT in BAILEY, Syn. Queensl. Fl.: 750 (1883); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 702 no. 6780 (1925); ROGERS, Austrobaileya **1** (5): 505 (1982); FILSON, Checklist Austr. Lich. 1. ed.: 50 (1983); FILSON, Checklist Austr. Lich. 2. ed.: 64 (1986); FILSON, Austr. Fl. Fauna Ser. **4**: 130 (1986).

Type: AUSTRALIA: Queensland, Brisbane, 1878, leg. J.M.Bailey (BRI! (vol. 2 p. 24 n. 261), holotype; BM!, BRI!, isotypes - see also ROGERS 1982b) - [containing stictic acid (excipulum K + yellow)].

DESCRIPTION:

Thallus: rimose, up to 100 mm diam., 0.2 - 0.6 mm thick.

AREOLES: irregularly shaped, grey to creamy whitish, plane, with mostly smooth surface, c. 0.5 - 1 mm, max. 0.8 - 1.5 mm diam. Cortex 20 - 25 μ m thick; upper cell layer not pigmented; hyphae c. 3 - 4.5 μ m diam.; epinecral layer not developed. Algal layer c. 30 - 100 μ m thick; algal cells c. 8 - 10 μ m, max. 10 - 13 μ m diam. Medulla I-; hyphae 2.5 - 4 μ m thick.

HYPOTHALLUS: not obvious.

Apothecia: round to roundish, mostly dispersed, 10 - 60/cm², (sub-) immersed to sessile and not constricted at the base, c. 0.6 - 0.8 mm, max. 0.9 - 1.2 mm diam. Disc mostly plane, grey to brown-black, matt, more or less pruinose. Margin at first more or less developed, later persistent, black to grey, matt to subnitid.

EXCIPULUM: max. 70 - 180 μ m, lateral of hymenium 70 - 135 μ m thick or reduced. Ectal zone brown to black-brown; pigmented zone 13 - 20 μ m tall; hyphae 3.5 - 4 μ m diam., with lumina of 1 - 1.8 μ m. Inner zone colourless to pale brown; hyphae 3 - 4 μ m diam., with lumina of 1 - 1.8 μ m. Medullary zone not distinct.

HYPOTHECIUM: dark brown, 230 - 400 μ m thick; hyphae 2.5 - 4 μ m diam.; subhymenial layer colourless, 25 - 40 μ m thick.

HYMENIUM: 80 - 110 μ m tall, colourless, I+ blue, I_{conc.}+ blue. Epihymenium brown, 8 - 13 μ m tall. Paraphyses more or less branched and anastomosing, 1.2 - 1.8 μ m, apices 1.5 - 3 μ m thick. Asci c. 60 - 75 x 14 - 19 μ m; tholus max. 18 - 20 μ m, min. 7 - 10 μ m thick; outer amyloid wall layer c. 1 μ m thick, I+ blue, I_{conc.}+ blue-brown; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 15 - 20 x 7 - 11 μ m.

Pycnidia: immersed. Conidia 8 - 9 - 10.3 - 13 x 0.9 - 1.3 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K+ yellow, C-, P+ orange.

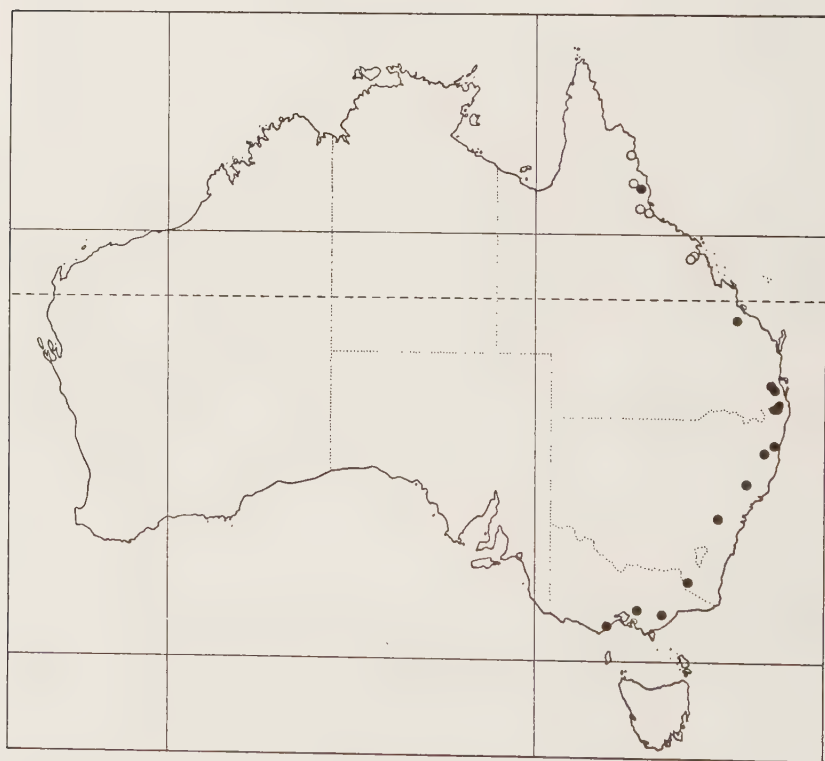
Two chemotype observed:

- containing stictic acid (major), constictic acid (?) (minor), norstictic acid (minor or traces) (31 specimens examined): var. *albocaerulescens*;
- containing norstictic acid (major), connorstictic acid (minor or traces) (14 specimens examined): var. *polycarpiza*.

DISTRIBUTION:

The world distribution of *P. albocaerulescens* has been illustrated in HERTEL & KNOPH (1984: 479 - 485, fig. 1 - 3) and HERTEL (1987b: 331, fig. 3). In the Northern Hemisphere, the species (incl. var. *polycarpiza*) occurs in North America (Eastern United States and adjacent

Canada) (GOWAN & BRODO 1988, GOWAN 1989b), in central and eastern Europe (Belgium, West Germany, Switzerland, Austria, Italy, Czechoslovakia, Rumania, Yugoslavia, U.S.S.R), and in Asia, where it is distributed in India, China, Taiwan, Korea and Japan (HERTEL 1977). In the Southern Hemisphere, the species was reported from Indonesia (Java, Sumatra), New Caledonia, New Zealand and Australia (incl. Tasmania). Within continental Australia, *P. albocaerulescens* occurs in the rainforests of the Great Dividing Range from the north of Qld to N.S.W and Vic., growing on siliceous boulders. The northern boundary at lower altitudes for the stictic acid race appears to lie between 21° and 24° latitude. Only one stictic acid containing specimen has been collected in North Queensland at 17°23'S at c. 1500 m (GR 4843) (map 54).



Map 54. Distribution of *Porpidia albocaerulescens*: var. *albocaerulescens* [●] var. *polycarpiza* [○] in continental Australia

The norstictic acid race (var. *polycarpiza*) has been described from the Phillipines and was also reported by HERTEL (1977, 1981a) from the southern Mediterranean region, from India, China, Indonesia and by GOWAN 1989b from North America. Obviously, the norstictic acid race has a centre of distribution in the subtropical and tropical regions of South-East Asia.

NOTES:

This species is ecologically different from the other species of *Porpidia* occurring in Australia. It grows at lower altitudes like *P. crustulata*, but reaches tropical latitudes. *P. albocaerulescens* is characterized by subimmersed apothecia, an excipulum with a well developed medullary zone, a dark brown hypothecium, a non-amyloid medulla, and the presence of stictic acid and/or norstictic acid. Within Australia, the two chemotypes of *P. albocaerulescens* show striking differences in their distribution, but no other correlating anatomical characteristics could be observed. Following the concept of HERTEL (1977), the two chemical strains are treated as varieties of the one species.

SPECIMENS EXAMINED:

Queensland: Atherton Tablelands, Bellenden Ker Range, Bartle Frere North West Peak, 17°23'S, 145°48'E, exposed granite outcrops near peak, c. 1500 m, 1.iii.1986, leg. G.Rambold 4843 (M); -- Kroombit Tops National Park, 24°22'S, 151°00'E, 700 m, 3.ix.1985, leg. R.W.Rogers 7941, 7943 (BRIU); -- Samford - Mt Glorious road, near B.Rose Park, 27°22'S, 152°50'E, 15.vi.1983, leg. R.W.Rogers 2723 (BRIU); -- Brisbane, [27°28'S, 153°01'E], [no date], leg. F.M.Bailey (type of *Lecidea subnubila* Stirt., BM, BRI 354978); -- 5 km N of Numinbah Valley, along the Nerang River, [28°08'S, 153°14'E], 120 m, 20.viii.1976, leg. J.A.Elix 2552 (ANUC, MEL); -- Neranwood, 14.i.1982, leg. R.W.Rogers 2560 (BRIU).

New South Wales: McPherson Range, Grands Creek E of Cougal, 28°22'S, 153°01'E, 800 m, 29.viii.1986, leg. J.Hafellner 155524 (hb. Hafellner); -- Tweed Range, Border Ranges National Park NE of Wiangaree, The Pinnacle, 28°23'S, 153°07'E, c. 1000 m, 31.viii.1986, leg. J.Hafellner 15513 (hb. Hafellner); -- Border Ranges National Park, Brindle Creek Walk, 28°23'S, 153°04'E, temperate rainforest beside creek, 9.ii.1986, leg. G.Rambold 4401 (M, NSW); -- North Coast, below Waihou Trig Station, 25 km NW of Coffs Harbour, 30°06'S, 153°02'E, 340 m, 12.x.1978, leg. D.Verdon 3821 (CBG, M); -- New England National Park, Point Lookout, 30°29'S, 152°25'E, basaltic boulders in dry sclerophyll forest, c. 1563 m, 6.ii.1986, leg. G.Rambold 4316, 4329 (M); -- Point Lookout, 30°29'S, 152°25'E, x.1967, leg. D.McVean 67192 (CBG); -- New England National Park, Lyrebird Track, 30°30'S, 152°24'E, basaltic boulders in temperate rainforest, 1300 - 1400 m, 6.ii.1986, leg. G.Rambold 4350 (M, NSW), 4353 (M); -- Barrington Tops National Park, Gloucester Tops, Negrohead Beech Forest Walking Trail, 32°05'S, 151°35'E, mossy low boulders in temperate rainforest with *Nothofagus*, c. 1200 m, 4.ii.1986, leg. G.Rambold 4228 (M), 4229, 4247, 4254 (M, NSW); -- Jenolan, [33°49'S, 150°02'E], [no date, no collector], (NSW 180258); -- Minnamurra Falls Reserve, S of Wollongong, 23.9.1967, leg. W.A.Weber (COLO L-47258); -- 1 km N of Pipers Lookout, Brown Mtn, 17 km SE of Nimmitabel, [36°36'S, 149°23'E], 920 m, 18.ii.1982, leg. J.A.Elix 9651 (ANUC).

Victoria: Yarra River, Warburton, [37°45'S, 145°42'E], xii.1885, leg. F.R.M.Wilson (NSW 180237); -- Warburton, [37°45'S, 145°42'E] 28.ii.1901, leg. R.A.Bastow (MEL 7007); -- Yarra River, Warburton, xii.1885, leg. F.R.M.Wilson (NSW 155866, NSW 155867); -- On Nicholson Creek upper Maffra, [37°58'S, 146°59'E], ix.1886, leg. F.R.M.Wilson (NSW 155869); -- Erskine River, Lorne, [38°32'S, 143°58'E], 4.ii.1886, leg. F.R.M.Wilson (NSW 155868).

Porpidia albocaerulescens var. *polycarpiza* (Vain.) Rambold & Hertel
comb. nov.

= *Lecidea polycarpiza* Vain., Ann. Acad. Sci. Fenn., Ser. A, 15 (6): 136-137 (1921).

= *Huilia albocaerulescens* var. *polycarpiza* (Vain.) Hertel, Herzogia 3: 373 (1975); Khumbu Himal 6 (3): 207 - 210 (1977).

Type: PHILIPPINES: Luzon: Subprov. Benguet, Kabayan, x./xi.1915, leg. E.D.Merrill (TUR-Vain. 25.027, holotype) - [fide HERTEL 1977].

Description and discussions see under var. *albocaerulescens*.

SPECIMENS EXAMINED:

Queensland: Big Tableland, 26 km S of Cooktown, 15°43'S, 145°17'E, 610 m, 4.vii.1984, leg. J.A.Elix 17313 (ANUC); -- Mt Baldy, 4 km SW of Atherton, 17°16'S, 145°23'E, 1060 m, 2.vii.1984, leg. H.Streimann 30631 (CBG); -- Lannercoast State Forest, Blue Water Creek, Old Mill Road, 39 km WSW of Ingham, 18°45'S, 145°48'E, 600 m, 19.vi.1984, leg. J.A.Elix 15583 (ANUC); -- Crystal Creek National Park, Little Crystal Creek, 19°01'S, 146°16'E, rocky outcrops and boulders beside falls, c. 365 m, 25.ii.1986, leg. G.Rambold 4802 (M), 4806 (M, BRI); -- Eungella National Park, NW of Mackay, Mt Dalrymple, 21°02'S, 148°38'E, granite outcrops on summit, 1240 m, 20.ii.1986, leg. G.Rambold 4639 (M); -- Mackay, walking trail from Mt Dalrymple Road to Dalrymple summit, 21°03'S, 148°37'E, subtropical rainforest, 1000 - 1100 m, 19.ii.1986, leg. G.Rambold 4572, 4584, 4588, 4603, 4608 (M); -- Eungella National Park, NW of Mackay, track along Broken River, 21°10'S, 148°29'E, subtropical rainforest between Broken River Camping Area and Platypus Pool, 680 m, 18.ii.1986, leg. G.Rambold 4559, 4560 (M).

Porpidia contraponenda (Arnold) Knoph & Hertel in Hertel & Knoph

HERTEL & KNOPH, Mitt. Bot. Staatssamml. München 20: 477 (1984); GOWAN, Bryologist 92: 40 - 41 (1989).

= *Lecidea contraponenda* Arnold, Verh. K.K. Zool.-Bot. Ges. Wien 36: 79 (1886); ZAHLBRÜCKNER, Catal. Lich. Univ. 3: 546 no. 6377 (1925); 8: 337 (1932).

Type: AUSTRIA: Tirol: "Auf kleinen Gneisblöcken am Fußwege zwischen Kühthei und den Finsterthaler Seen", 16.vii.1884, leg. F. Arnold (ARNOLD, Lich. Exs. 1055, M!, holotype, isotype) - [containing methyl 2'-O-methylmicrophyllinate].

DESCRIPTION:

Thallus: rimose to areolate, up to 55 mm diam., c. 0.2 mm thick.

AREOLES: irregularly shaped to angular, grey to white, plane to convex, with rough surface, c. 0.5 - 0.6 mm, max. 0.8 - 1.1 mm diam. Cortex c. 20 µm thick; upper cell layer not pigmented; hyphae c. 3 - 3.5 µm diam.; epinecral layer not developed. Algal layer c. 80 - 90 µm thick; algal cells c. 10 - 11 µm, max. 12 - 14 µm diam. Medulla I-; hyphae 3 - 3.5 µm thick.

HYPOTHALLUS: black, obvious at the thallus margin.

Apothecia: round, dispersed to crowded, 30 - 100/cm², sessile, constricted at the base, c. 0.6 - 0.8 mm, max. 0.8 - 1.2 mm diam. Disc plane to convex, black, matt, epruinose. Margin at first distinct, later persistent, black, matt.

EXCIPULUM: max. 110 - 120 µm, lateral of hymenium 80 - 115 µm thick. Ectal zone black-brown; pigmented zone diffuse, c. 25 - 30 µm tall; hyphae 3.5 - 4 µm diam., with lumina of c. 1 µm. Inner zone black-brown to brown; hyphae 4 - 5 µm diam., with lumina of 1 - 1.8 µm. Medullary zone not distinct.

HYPOTHECIUM: black-brown, 150 - 300 µm thick; hyphae 3.5 - 4 µm diam.; subhymenial layer colourless, 20 - 30 µm thick.

HYMENIUM: 70 - 85 µm tall, colourless, I+ blue, Iconc.+ bluish. Epihymenium grey-green, 15 - 25 µm tall. Paraphyses branched and anastomosing, 1.3 - 1.8 µm, apices 1.5 - 2.8 µm thick. Asci c. 50 - 78 x 14 - 16 µm; tholus max. 13 - 20 µm, min. 6 - 13 µm thick; amyloid tube c. 2 - 4 µm broad: outer amyloid wall layer 0.5 - 1 µm thick, I+ orange, Iconc.+ orange; non-amyloid wall layer 0.4 - 0.6 µm thick. Spores ellipsoid, 10 - 18 (- 20) x 6 - 11 µm.

Pycnidia: immersed. Conidia 6 - 6.7 - 8 x 1 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed: containing methyl 2'-O-methylmicrophyllinate, porphyritic acid (in traces or lacking) (11 specimens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! KNOPH (unpubl.) reports *P. contraponenda* for North, Central, and West Europe (Norway, Sweden, England, Wales, France, West Germany, Switzerland, Austria, Italy, U.S.S.R.), GOWAN (1989b) reports it for Western North America. *P. contraponenda* grows on more or less sheltered siliceous rock, in forests or in open situation. In Australia, the species has been collected in the alpine zone of the Snowy Mountains and the Brindabella Range (map 55), growing in exposed position.

NOTES:

P. contraponenda is well characterized by a greyish, creamy-whitish to white thallus, an Iconc. + orange-red outer ascus wall and the presence of methyl 2'-O-methylmicrophyllinate, which is known to occur also in *Porpidia diversa* Gowan, described from North America (GOWAN & BRODO 1988, GOWAN 1989).

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, 4 km SW of Kiandra, 35°54'S, 148°27'E, low outcrops beside track between Selwyn Quarry and Mt Selwyn, c. 1600 m, 20.i.1986, leg. G.Rambold 3717, 3720 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3439, 3442 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3479 (M); -- Kosciusko National Park, near Rawsons Pass, above Lake Cootapatamba, 36°27'S, 148°17'E,



Map 55. Distribution of *Porpidia contraponenda* in continental Australia

9.ii.1978, leg. D.Verdon 3234 (CBG); -- Kosciusko National Park, Mt Kosciusko, Lake Cootapatamba, 36°28'S, 148°18'E, 2050 m, 1.iii.1985, leg. H.Hertel 32091 (M).

A.C.T.: Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, rhyolite rocks, 1420 m, 27.i.1986, leg. G.Rambold 4067 (M).

Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3116 (M); -- Great Dividing Range, 3 km ENE of Mt Hotham, 200 m E of Derrick Hut, 36°58'S, 147°10'E, c. 1700 m, 2.i.1986, leg. G.Rambold 3016 (M); -- Great Dividing Range, Mt Hotham, 36°59'S, 147°07'E, 1860 m, 3.i.1986, leg. G.Rambold 3093 (M).

***Porpidia crustulata* (Ach.) Hertel & Knoph in Hertel**

- HERTEL, Beih. Nova Hedwigia **79**: 435 (1984); Mitt. Bot. Staatssamml. München **21**: 329 - 330 (1985); SCHWAB, Mitt. Bot. Staatssamml. München **22**: 380 - 388 (1986); HERTEL, Mitt. Bot. Staatssamml. München **23**: 332 - 333 (1987); GOWAN, Bryologist **92**: 41 - 42 (1989).
= *Lecidea parasema* δ . (L.) *crustulata* Ach., Lichenogr. Univ.: 176 (1810).
= *Lecidea crustulata* (Ach.) Spreng., Syst. Veget. ed. 16, **4**: 258 (1827).
ZAHLEBRUCKNER, Catal. Lich. Univ. **3**: 549 - 551 no. 6385 (1925); **8**: 337 (1932); **10**: 303 - 304 (1940); HERTEL, Willdenowia **6**: 238 - 240 (1971).
= *Biatora crustulata* (Ach.) Hepp, Flecht. Europ. no. 130 (1853).
= *Lecidea platycarpa* var. *crustulata* (Ach.) Oliv., Flore Lich. Orne **2**: 207 (1884) [n.v.].
= *Haplocarpon crustulatum* (Ach.) Choisy, Bull. Mens. Soc. Linn. Lyon **19**: 159 (1950); HERTEL, Decheniana **127**: 60 - 61 (1975).
= *Huilia crustulata* (Ach.) Hertel, Herzogia **3**: 373 (1975); HERTEL, Herzogia **3**: 371 (1975); Khumbu Himal **6** (3): 210 - 214 (1977); HERTEL & ZHAO, Lichenologist **14**: 144 - 145 (1982); INOUE, J. Jap. Bot. **58**: 163 - 166 (1983); GALLOWAY, Fl. New Zeal. Lich.: 186 - 187 (1985).
Type: SWITZERLAND: [no locality, no date], leg. J. Schleicher 690 (H-Ach, lectotype - designated in HERTEL 1977).

DESCRIPTION:

Thallus: verrucose to rimose or cryptothalline, up to 60 mm diam., 0.05 - 0.2 mm thick.

AREOLES: irregularly shaped, creamy white, occasionally more or less rusty coloured, plane, with rough surface, c. 0.4 - 0.5 mm, max. c. 0.8 mm diam. Cortex 10 - 35 μ m thick; upper cell layer colourless, occasionally incrustated with rusty coloured granules; hyphae c. 3 - 5 μ m diam.; epinecral layer mostly not developed. Algal layer c. 60 - 65 μ m thick; algal cells c. 9 - 10 μ m, max. c. 14 μ m diam. Medulla I -; hyphae 3.5 - 4 μ m thick.

HYPOTHALLUS: grey to black, more or less obvious between the areoles and/or at the thallus margin.

Apothecia: round to roundish, dispersed to crowded, 25 - 90/cm², sessile, constricted at the base, c. 0.5 - 0.7 mm, max. 0.8 - 1.5 mm diam. Disc plane to subconvex, black, matt, epruinose. Margin at first distinct, later more or less persistent, black, occasionally rusty, matt. EXCIPULUM: max. 80 - 120 μ m, lateral of hymenium 60 - 100 μ m thick. Ectal zone dark brown; pigmented zone c. 10 - 15 μ m tall; hyphae 3 μ m diam., with lumina of c. 1 μ m. Inner zone brown to dark brown towards the centre; hyphae 4.5 - 8 μ m diam., with lumina of 0.8 - 1 (- 2) μ m. Medullary zone not developed.

HYPOTHECIUM: dark brown, 150 - 270 μ m thick; hyphae 3 - 4 μ m diam.; subhymenial layer colourless, 10 - 20 μ m thick.

HYMENIUM: 60 - 110 μ m tall, colourless, I+ blue, I_{conc}+ blue. Epihymenium olivaceous, 12 - 16 μ m tall. Paraphyses branched and anastomosing, 1.2 - 1.8 μ m, apices 2 - 3 μ m thick. Asci c. 55 - 70 x 11 - 15 μ m; tholus max. 12 - 15 μ m, min. 6 - 9 μ m thick; amyloid tube up to

c. 5 μ m broad; outer amyloid wall layer 0.5 μ m thick, I+ orange, Iconc.+ orange-red; non-amyloid wall layer c. 0.5 μ m thick. Spores ellipsoid, 9 - 9.7 - 13.7 - 18 x 6 - 6.9 - 7.2 - 9.5 μ m.

Pycnidia: immersed. Conidia 9 - 10.6 - 14 x 1 μ m.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K+ yellow, C-, P+ orange.

Two chemotypes observed:

- a) containing stictic acid (major), constictic acid (?), norstictic acid (minor, trace or not) (53 specimens examined);
- b) containing norstictic acid (1 specimen examined).

DISTRIBUTION:

Cosmopolitan. New to continental Australia! *P. crustulata* is one of the most ubiquitous crustose lichens, which avoids only extremely hot tropical or extremely cold climates. It occurs in most areas of the holarctic region (HERTEL 1977: 211; SCHWAB 1986: 384 - 388; GOWAN 1989b). From the Southern Hemisphere, reliable reports exist for South America (Venezuela, Patagonia) (HERTEL 1971a: 238 - 239), South Africa (HAIDUK unpubl.), Indonesia (Java), New Zealand, Tasmania and the Kerguelen (HERTEL 1977, 1984, 1987b). Within continental Australia, the species occurs in S.A., N.S.W., A.C.T. and Vic. (map 56), growing on siliceous rock, especially on small stones scattered on the ground in sheltered or open positions, from low altitudes to the (sub-)alpine zone.

NOTES:

Porpidia crustulata is closely related to *P. macrocarpa*. On the basis of Australian material, both taxa can easily be distinguished. *P. crustulata*, which grows in Australia between c. 100 m and 1950 m altitude, contains stictic acid (one specimen contains norstictic acid) and has relatively small apothecia and spores. *P. macrocarpa*, with large apothecia and spores, was found only twice at 2050 m, and both specimens lacked lichen substances. In arctic regions with alpine situations at relatively low altitudes (e.g. in Iceland or Greenland), the delimitation of these two taxa can be rather difficult. Detailed discussions of this problem are given by HERTEL (1977: 211), INOUE (1983b: 165 - 166) and SCHWAB (1986: 415 - 422).

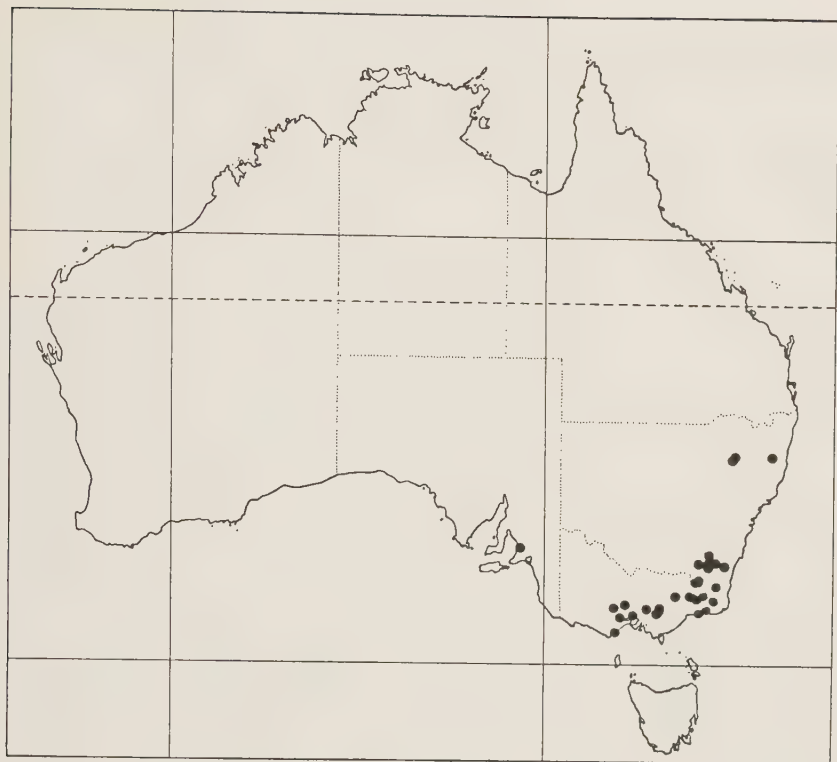
EXSICCATA EXAMINED (Australian material):

HERTEL, Lecideac. Exs. no.: 173, 212 ("*Porpidia crustulata*")

SPECIMENS EXAMINED:

South Australia: Mt Lofty, [34°59'S, 138°43'E], 12.ix.1887, leg. F.R.M. Wilson (NSW 180235).

New South Wales: New England National Park, Lyrebird Track, 30°30'S, 152°24'E, basaltic boulders in heath, 1300 - 1400 m, 6.ii.1986, leg. G.Rambold 4338 (M, NSW); -- Du Fours Lookout, 1 km NE of Mount Wilson, Giant Tree Cathedral of Ferns, 33°30'S, 150°23'E, wet sclerophyll forest, 890 m, 2.ii.1986, leg. G.Rambold 4202 (HERTEL, Lecideac. Exs. 212, M); -- Blue Mountains, 4 km SE of Blackheath walking track from Neates Glen via Grand Canyon to Evans Lookout, [33°40'S, 150°18'E], 900 - 1000 m, 3.i.1985, leg. H.Mayrhofer 6716 (GZU);



Map 56. Distribution of *Porpidia crustulata* in continental Australia

-- Great Dividing Range, 6 km E of Captains Flat, 35°35'S, 149°30'E, 1220 m, 25.x.1979, leg. H.Streimann 9504 (CBG, M); -- Kosciusko National Park, 12 km from Rules Point on Rules Point - Brindabella road, 35°37'S, 148°36'E, pebbles on bare soil in grassland, 1400 m, 21.i.1986, leg. G.Rambold 3778 (M, NSW), 3779 (M); -- Southern Tablelands, head of Mongarlowe River, 27 km SE of Braidwood, 35°41'S, 149°54'E, 1000 m, 21.xi.1979, leg. D.Verdon 4637 (CBG, H, M, NICH); -- Kosciusko National Park, foot of Round Mtn, 28 km NE of Khancoban, 36°17'S, 148°35'E, 1550 m, 10.iv.1985, leg. J.A.Elix 19112 (ANUC); -- Kosciusko National Park, Diggers Creek SE of Island Bend, 36°20'S, 148°29'E, 1380 m, 3.iii.1985, leg. H.Hertel 31909, 31911 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3630 (M); -- Kosciusko National Park, near Blue Lake, [36°24'S, 148°19'E], 6500 ft, 8.ii.1968, leg. W.A.Weber & D.McVean (COLO L-49847); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3455 (M); -- Kosciusko National Park, crossing of Snowy River on trail from Charlottes Pass to Blue Lake, [36°26'S, 148°19'E], 6000 ft, 8.ii.1968, leg. W.A.Weber & D.McVean

(COLO L-49826); -- Glenbog State Forest, Snowy Mountains Hwy, between Nimmitabel and Bemboka, near ruined bridge over Rutherford Creek, 36°35'S, 149°26'E, c. 900 m, 17.viii.1985, leg. C.H.Miller 295 (CANB 362295); -- Gang Gang Creek, 17 km NW of Adaminaby, 36°56'S, 148°47'E, 26.xii.1978, leg. H.Streimann 7373 (CBG, H, M, US); -- Bondi State Forest, 45 km S of Bombala along Cann Valley Hwy, [37°10'S, 149°20'E], 23.xi.1978, leg. J.A.Elix 5406 (ANUC).

A.C.T.: Canberra, Australian National Botanic Gardens, road above "Rainforest Gully", 35°16'S, 149°05'E, 10.x.1984, leg. J.A.Curnow 20 (CBG); -- Capital Hill, Canberra, [35°17'S, 149°13'E], 13.iii.1979, leg. H.Streimann 7569 (CBG, H, M); -- 0.5 km S of Gibraltar Falls, 40 km SW of Canberra, [35°40'S, 149°E], 17.x.1981, leg. J.A.Elix 9147 (ANUC); -- Naas Creek, 57 km S of Canberra, 35°49'S, 148°56'E, 1677 m, 18.viii.1975, leg. D.Verdon 1704 (CBG).

Victoria: Great Dividing Range, along road from Benambra to Wulgulmerang near the junction of Mt Cobberas Track, 36°54'S, 148°06'E, c. 1200 m, 27.ii.1985, leg. H.Hertel 31561 (HERTEL, Lecideac. Exs. 173), 31564 (M); -- Bogong High Plains, along the Langford West Aqueduct, Middle Creek between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, c. 1600 m, 26.ii.1985, leg. H.Hertel 31419, 31420, 31424, 31428, 31430, 31433, 31454, 31456, 31457, 31458, 31459, 31504 (M); -- Great Dividing Range, Mt Wombargo near Rocky Plains, 36°56'S, 148°12'E, c. 1400 m, 27.ii.1985, leg. H.Hertel 31527 (M); -- Mac Killop Bridge, 14 km E of Wulgulmerang, 37°05'S, 148°25'E, 200 m, 12.i.1986, leg. G.Rambold 3345 (M, MEL); -- Summit of Mt Macedon, [37°23'S, 144°37'E], 7.iii.1970, leg. R.Filson 11537 (MEL); -- Summit of Mt Skene, [37°26'S, 146°23'E], 6.i.1965, leg. H.A.Morrison (MEL 1018480); -- State Forest, about 8 km S of Creswick, [37°27'S, 143°54'E], 29.viii.1974, leg. R.Filson 15070 (MEL); -- Club Terrace - Combienbar road, 6 km N of Club Terrace, 37°29'S, 148°56'E, 120 m, 27.ix.1985, leg. J.A.Elix 19508 (ANUC); -- Buxton, Mt Margaret saddle, Blue Range, 37°35'S, 145°42'E, 11.x.1981, leg. V.Wirth 10742 (STU); -- Baw Baw National Park, 6 km SE of Mt Erica, 37°35'S, 146°23'E, on clay road cutting on Mt Erica Road, 900 - 1000 m, 10.i.1986, leg. G.Rambold 3245, 3250, 3261 (M); -- Mt Lookout, [37°42'S, 146°21'E], iv.1889, leg. F.R.M.Wilson (NSW 155841); -- Mt Raymond, 13 km E of Orbost, 37°43'S, 148°36'E, 290 m, 27.ix.1985, leg. J.A.Elix 19457 (ANUC); -- Kew, [37°48'S, 145°01'E], 3.v.1886, leg. F.R.M.Wilson (NSW 155896); -- Kew, v.1887, leg. F.R.M.Wilson (NSW 155897); -- Kew, 27.x.1885, leg. F.R.M.Wilson (NSW 155903); -- Kew, 3.v.1886, leg. F.R.M.Wilson (NSW 155907); -- Brisbane Ranges, [37°55'S, 144°20'E], 5.ix.1967, leg. D.H.Ashton (MEL 25249); -- Road W.2 Tyers to Walhalla road, c. 6 km N of Tyers, 11.i.1975, leg. R.Filson 15281 (MEL); -- Lorne, [38°32'S, 143°58'E], v.1887, leg. F.R.M.Wilson (NSW 155766); -- Chapple Vale road junction, 13.vi.1964, leg. G.Beaton 904 (BM); -- Glenmaggie, [no date], leg. F.R.M.Wilson (NSW 155900a); -- Midland Hwy near Tarra Valley, viii.1961, leg. S.L.Thrower (COLO L-37015).

Porpidia macrocarpa (DC.) Hertel & Schwab in Hertel

HERTEL, Beih. Nova Hedwigia 79: 437 (1984); HERTEL & KNOPH, Mitt. Bot. Staatssamml. München 20: 473, 475 (1984); HERTEL, Mitt. Bot. Staatssamml. München 21: 313 - 314 (1985); SCHWAB, Mitt. Bot. Staatssamml. München 22: 410 - 428 (1986); FILSON, Checklist Austr. Lich. 3. ed.: 20, 157 (1988); GOWAN, Bryologist 92: 50 - 51 (1989).

= *Patellaria macrocarpa* DC. in Lam. & DC., Fl. Franc., ed. 3, 2: 347 (1805).

≡ *Lecidea macrocarpa* (DC.) Steud., Nomenclat. Bot. 2: 245 (1824); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 626 - 633 no. 6551 (1925); 8: 348 (1932); 10: 313 (1940).

≡ *Haplocarpon macrocarpum* (DC.) Choisy in Tronchet, Bull. Mens. Soc. Linn. Lyon 5: 21 (1936); HERTEL, Decheniana 127: 61 (1975).

≡ *Huilia macrocarpa* (DC.) Hertel, Herzogia 3: 374 (1975); HERTEL, Khumbu Himal 6 (3): 219 - 222 (1977); INOUE, J. Jap. Bot. 58: 225 - 228 (1983).

Type: FRANCE: "Alpes", [no locality, no date], leg. A.DeCandolle (?) (G-DC, holotype - [fide HERTEL 1977 and SCHWAB 1986]).

DESCRIPTION:

Thallus: rimose, up to 60 mm diam., 0.1 mm thick.

AREOLES: irregularly shaped, grey to rusty coloured, plane, with rough surface, c. 0.4 mm, max. 0.6 mm diam. Cortex c. 20 - 30 µm thick; upper cell layer unpigmented, occasionally incrustated with rusty coloured granules; epinecral layer not developed. Medulla I -.

HYPOTHALLUS: grey, obvious between the areoles.

Apothecia: round to roundish, dispersed, 12 - 15/cm², sessile, constricted at the base, c. 0.8 - 1 mm, max. c. 1.6 mm diam. Disc subconvex to convex, black, matt, epruinose. Margin at first distinct, later more or less vanishing, black, matt.

EXCIPULUM: max. 150 - 200 µm, lateral of hymenium 130 - 200 µm thick. Ectal zone black-brown; pigmented zone 10 - 15 µm tall; hyphae 3 - 5 µm diam., with lumina of 1.3 - 1.9 µm. Inner zone brown, dark brown towards the centre; hyphae 6 - 8 µm diam., with lumina of 1 - 2 µm. Medullary zone not obvious.

HYPOTHECIUM: brown to dark brown, up to 300 - 350 µm thick; hyphae 3 - 5 µm diam.; subhymenial layer colourless, 20 - 25 µm thick.

HYMENIUM: 95 - 120 µm tall, colourless, I+ blue, Iconc. + blue. Epihymenium olivaceous, 12 - 20 µm tall. Paraphyses branched and anastomosing, 1.5 - 1.8 µm, apices 3 - 4 µm thick. Asci c. 80 - 90 x 18 - 20 µm; tholus max. 10 - 18 µm, min. 5 - 14 µm thick; amyloid tube c. 5 - 8 µm broad; outer amyloid wall layer 0.5 - 1 µm thick, I+ orange, Iconc.+ orange-red; non-amyloid wall layer 0.5 µm thick. Spores ellipsoid, 14 - 21 x 7 - 10.5 µm.

Pycnidia: immersed. Conidia: 9 - 10.7 - 14 x 1 - 1.1 µm.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing no lichen substances (2 specimens examined).

DISTRIBUTION:

Bipolar. New to Australia! *P. macrocarpa*, an often misunderstood species, is widely distributed in North America (GOWAN 1989b), Europe and Asia (HERTEL 1977, SCHWAB 1986: 422). For the Southern Hemisphere only one reliable report exists for New Zealand (Otago) (HERTEL 1985: 313). In continental Australia, *P. macrocarpa* has been collected near the summit of Mt Kosciuszko at an altitude of 2050 m (map 57).



Map 57. Distribution of *Porpidia macrocarpa* in continental Australia

NOTES:

No new aspects to the species concept of the *P. macrocarpa*-complex could be found on the basis of the two Australian specimens. (See also notes under *P. crustulata*.)

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, Mt Kosciusko, Lake Coorapatamba, 36°28'S, 148°18'E, 2050 m, 1.iii.1985, leg. H.Hertel 32082, 32090 (M).

Porpidia soledizodes (Lamy) Knoph, Hertel & Rambold **comb. nov.**

- ≡ *Lecidea crustulata* var. *soledizodes* Lamy, Bull. Soc. Bot. France **30**: 410 (1883); NYLANDER, Flora **66**: 534 (1883); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 553 (1925); **8**: 337 (1932).
 - ≡ *Lecidea calcarea* var. *soledizodes* Boist., Nouv. Fl. Lich. **2**: 209 (1903) [n.v.].
 - ≡ *Lecidea soledizodes* (Lamy) Nyl. ex Sandst. ("*Lecidea soledizodes* (Lamy) Nyl.") Abhandl. Naturwiss. Verein Bremen **21**: 80 (1912); ZAHLBRUCKNER, Catal. Lich. Univ **10**: 322 no. 16359 (1940).
 - ≡ *Haplocarpon soledizodes* (Lamy) V.Wirth, Diss. Bot. **17**: 287 (1972).
 - ≡ *Huilia soledizodes* (Lamy) Hertel in Hawksworth, James & Coppins, Lichenologist **12**: 106 (1980); GOWAN, Bryologist **92**: 58 (1989).
- Type: FRANCE: Pyrénées Centrales: "Sur du marbre et du schiste, dans la sapinière du [Col du] Riou", 1943 m, [no date], leg. (?) M.E.Lamy - [n.v.].

DESCRIPTION:

Thallus: rimose, up to 55 mm diam., 0.1 mm thick, with distinct, roundish soralia of 0.25 - 0.35 mm diam.

AREOLES: irregularly shaped, creamy coloured, plane, with rough surface, c. 0.25 mm, max. 0.3 mm diam. Cortex: upper cell layer not pigmented; epinecral layer not developed. Algal cells c. 8 - 10 µm, max. c. 13 µm diam. Medulla I -; hyphae c. 3 - 4 µm thick.

HYPOTHALLUS: black to dark grey, obvious between the areoles and at the thallus margin.

Apothecia: round, dispersed, 25 - 30/cm², sessile, constricted at the base, c. 0.6 - 0.7 mm, max. 0.7 - 0.9 mm diam. Disc plane, black to greyish, matt, more or less pruinose. Margin at first distinct, later persistent, black, matt to nitid.

EXCIPULUM: max. c. 170 µm, lateral of hymenium 140 - 160 µm thick. Ectal zone brown; pigmented zone c. 10 µm tall; hyphae c. 3 µm diam., with lumina of 1 - 1.5 µm. Inner zone pale brown; hyphae 6 - 8 µm diam., with lumina of 1.2 - 2 µm. Medullary zone not developed.

HYPOTHECIUM: dark brown, c. 80 µm thick; hyphae c. 3 µm diam.; subhymenial layer colourless, 25 - 35 µm thick.

HYMENIUM: 80 - 85 µm tall, colourless, I+ blue, Iconc.+ blue. Epihymenium olivaceous, c. 10 µm tall. Paraphyses branched and anastomosing, c. 1.5 µm, apices c. 3 µm thick. Asci c. 60 - 65 x 9 - 10 µm; tholus max. 12 - 15 µm, min. 6 - 7 µm thick; amyloid tube 3.5 - 4.5 µm broad; outer amyloid wall layer c. 0.7 µm thick, I+ orange, Iconc.+ orange; non-amyloid wall layer c. 0.5 µm thick.

Spores ellipsoid, 12 - 15 x 5 - 6.5 µm.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K + yellowish, C-, P+ orange.

One chemotype observed, containing stictic acid and unknown fatty acid (bourgeanic acid ?) (2 specimens examined).

DISTRIBUTION:

New to the Southern Hemisphere! The species is known from North America (Canada) (GOWAN & BRODO 1988) and, according to KNOPH (unpubl.), from north-western and central Europe (Great Britain, France, West Germany, and northern Italy). It grows on siliceous rocks in humid localities, mostly in forest areas bordering mountain regions. Within Australia, *P. soledizodes* has been found in N.S.W. and Vic. (map 58), at altitudes comparable with those in Europe.

NOTES:

P. soledizodes is related to *P. crustulata*. Both species have relatively broad hyphae in the inner zone of the excipulum and contain stictic acid. The Australian specimens of *P. soledizodes* produce an additional fatty acid with R_F -classes similar to bourgeanic acid. The only other solediose species of *Porpidia* in the Southern Hemisphere is *P. austroshetlandica* Hertel, described from the South Shetland Islands. However, according to HERTEL (1984: 434), this species has rather thin hyphae in the excipulum (2 - 3 μm diam.).



Map 58. Distribution of *Porpidia soledizodes* in continental Australia

SPECIMENS EXAMINED:

New South Wales: Great Dividing Range, 6 km E of Captains Flat, 35°35'S, 149°30'E, 1220 m, 25.x.1979, leg. H. Streimann 9505b (CBG).

Victoria: Great Dividing Range, on road from Omeo to Corroyong, c. 10 km S of Sassafras Gap, 75 km S of Corroyong, 36°39'S, 147°42'E, c. 800 m, 28.ii.1985, leg. H. Hertel 31592 (M).

Porpidia speirea (Ach.) Kremp.

KREMPELHUBER, Denkschr. Bayer. Bot. Ges. Regensburg, 2. Abt., 4: 210 (1861); FILSON, Checklist Austr. Lich. 2. ed.: 120 (1986); Checklist Austr. Lich. 3. ed.: 20, 157 (1988); GOWAN, Bryologist 92: 51 - 53 (1989).

≡ *Lichen speireus* Ach., Lichenogr. Suec. Prodr.: 59 (1798).

≡ *Lecidea speirea* (Ach.) Ach., Method. Lich.: 52 - 53 (1803); SHIRLEY, Proc. Roy. Soc. Queensl. 6 (5): 167 (1889); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 692 - 694 no. 6731 (1925); 8: 358 (1932); 10: 322 (1940); HERTEL, Beih. Nova Hedwigia 24: 51 - 55 (1967); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); HERTEL, Herzogia 3: 386 - 397 (1975); Khumbu Himal 6 (3): 279 - 281 (1977); FILSON, Checklist Austr. Lich. 1. ed.: 50 (1983); SANTESSON, Lich. Sweden Norway: 175 (1984).

Type: SWEDEN: Östergötland: Väversunda s:n, Ombergs stup i Vättern vid Borgs udde, strandklippor, c. 90 m, 12.vii.1934, leg. R. Santesson 1030 (UPS, neotype - vide HERTEL 1975a: 386 - 397).

DESCRIPTION:

Thallus: rimose, areolate to more or less cryptothalline, up to 80 mm diam., 0.1 - 0.6 mm thick.

AREOLES: angular to irregularly shaped, chalky white to grey, irregularly convex, with rough to smooth surface, c. 0.5 - 1 mm, max. 1 - 2 mm diam. Cortex 15 - 40 µm thick; upper cell layer not pigmented; hyphae c. 3 µm diam.; epinecral layer not developed. Algal layer c. 50 - 80 µm thick; algal cells c. 9 - 10 µm, max. 10 - 12 µm diam. Medulla I + violet; hyphae 3 - 4 µm thick.

HYPOTHALLUS: black, obvious between the areoles and at the thallus margin.

Apothecia: roundish to round, dispersed to crowded, 10 - 40/cm², sessile, mostly constricted at the base, c. 0.9 - 1.6 mm, max. 1.3 - 2.8 mm diam. Disc convex, black to grey, matt, mostly epruinose, occasionally umbonate. Margin distinct, more or less persistent, black, subnitid to matt.

EXCIPULUM: max. 110 - 140 µm, lateral of hymenium 80 - 125 µm thick. Ectal zone black-brown; pigmented zone c. 15 µm tall; hyphae 3 - 3.5 µm diam., with lumina of c. 1 µm. Inner zone black-brown; hyphae 3 - 3.5 µm diam., with lumina of c. 1 µm. Medullary zone not obvious.

HYPOTHECIUM: dark brown, 150 - 550 µm thick; hyphae 3 - 3.5 µm diam.; subhymenial layer colourless to brownish, 5 - 30 µm thick.

HYMENIUM: 65 - 90 μm tall, colourless, I+ blue, I_{conc.}+ blue. Epiphy-
menium olivaceous to brown, 15 - 25 μm tall. Paraphyses branched and
anastomosing, 1.3 - 2 μm , apices 3 - 4 μm thick. Asci c. 65 - 70 x 18 -
20 μm ; tholus max. 18 - 23 μm , min. 5 - 11 μm thick; amyloid tube c. 6
- 7 μm broad; outer amyloid wall layer 0.3 μm thick, I+ blue, I_{conc.}+
blue-brown; non-amyloid wall layer 0.3 μm thick. Spores ellipsoid, 11
- 22 x 6 - 8 μm .

Pycnidia: immersed. Conidia: 9 - 10.3 - 13 x 1 μm .

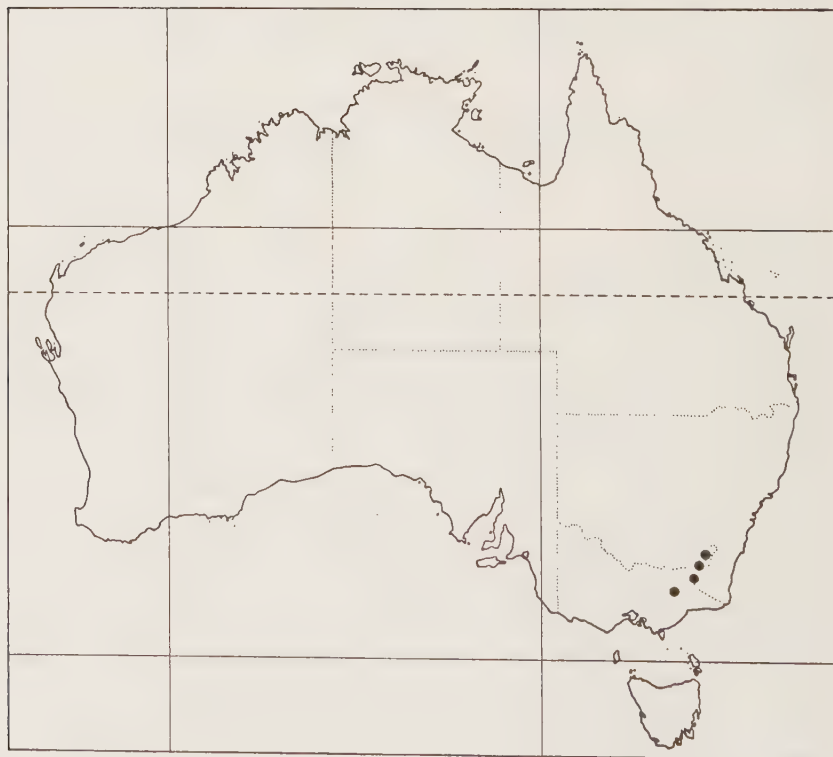
CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C-, P-; excipulum K-, C-, P-.

One chemotype observed, containing confluent acid (major), 2'-O-
methylperlatolic acid, 2'-O-methylmicrophyllinic acid (minor) (14 spec-
imens examined).

DISTRIBUTION:

Bipolar. New to the Southern Hemisphere! The report by SHIRLEY
(1889) for Queensland certainly refers to misidentified material which,
however, was not seen by the author. The species was hitherto known



Map 59. Distribution of *Porpidia speirea* in continental Australia

from the boreal and (sub-)arctic regions of Europe and North America and has been reported from China (HERTEL 1967, 1977, GOWAN & BRODO 1988, GOWAN 1989b). Within continental Australia, the species is known from the alpine zone in the SW of continental Australia (N.S.W., A.C.T., Vic.), growing on siliceous rock in open situations (map 59).

NOTES:

P. speirea is characterized by an amyloid medulla and an Iconc. + blue-brown outer ascus wall. It contains confluent acid as major substance. *P. umbonifera*, another Australian representative of *Porpidia* with an amyloid medulla, has a pale brownish inner zone of the excipulum and contains no detectable lichen substances. According to HERTEL (1967, 1977), *P. speirea* has a relatively wide ecological amplitude. In the alpine zone of European mountain areas it grows on more or less calciferous siliceous rock, especially on inclined or vertical rock surfaces. In northern Europe *P. speirea* also occurs on non-calciferous rock at lower altitudes. The type belongs to such a population.

In Australia, *P. speirea* has been found on non-calciferous rock, developing thalli, which are usually thinner and more whitish-grey than most of the European specimens examined. However, there are other Australian specimens which show a typically thick and chalky white thallus.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, 4 km SW of Kiandra, 35°54'S, 148°27'E, low outcrops beside track between Selwyn Quarry and Mt Selwyn, c. 1600 m, 20.i.1986, leg. G.Rambold 3722 (M); -- Kosciusko National Park, Blue Lake, S of Mt Twynam, 36°24'S, 148°19'E, 1900 - 1940 m, 2.iii.1985, leg. H.Hertel 31752, 31768 (M); -- Kosciusko National Park, Mt Guthrie, 36°26'S, 148°20'E, vertical and overhanging rock walls, c. 1800 m, 15.i.1986, leg. G.Rambold 3499 (M); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3531, 3535, 3546 (M); -- Kosciusko National Park, 2 km W of Charlottes Pass [36°26'S, 148°18'E], 1820 m, 5.xii.1979, leg. J.A. Elix 6548 (ANUC).

A.C.T.: Brindabella Range, 43 km WSW of Canberra, Aggie Gap, [35°28'S, 148°46'E], 1400 m, 14.xi.1981, leg. J.A.Elix 9534 (ANUC).

Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3120, 3121, 3124 (M), 3128 (M, MEL); -- Mt Hotham, [36°59'S, 147°07'E], 5000 ft, 17.i.1890, leg. F.R.M.Wilson (NSW 155895, "isotype" of *L. contigua* var. *umbonifera* Müll.Arg.).

***Porpidia umbonifera* (Müll.Arg.) Rambold comb. nov.**

= *Lecidea contigua* var. *umbonifera* Müll.Arg., Bull. Herb. Boissier 1 (2): 46 (1893); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 545 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 46 (1983); Checklist Austr. Lich. 2. ed.: 58 (1986); Austr. Fl. Fauna Ser. 4: 113 (1986); Checklist Austr. Lich. 3. ed.: 18, 102 (1988).

Type: AUSTRALIA: Victoria: Mt Hotham, 5000 ft, [comm.] 1891, leg. F.R.M. Wilson 1403 (G!, holotype) - [containing no substances]; (The "isotype" NSW 155895 [coll. 17.i.1890] belongs to *P. speirea*.)

DESCRIPTION:

Thallus: areolate to verrucose, up to 110 mm diam., 0 - 0.2 mm thick. **AREOLES:** angular to irregularly shaped, white, occasionally rusty coloured, subconvex to convex, with rough to smooth surface, c. 0.5 mm, max. 0.6 - 0.8 mm diam. Cortex c. 25 µm thick; upper cell layer grey to colourless; hyphae c. 4 µm diam.; epinecral layer not developed. Algal cells c. 9 µm, max. 10 - 12 µm diam. Medulla I + violet; hyphae 3 µm thick.

HYPOTHALLUS: black, obvious between the areoles.

Apothecia: round to roundish, dispersed to crowded, 7 - 40/cm², sessile, constricted at the base, c. 0.6 - 0.8 mm, max. 1.1 - 1.8 mm diam. Disc subconvex, black, matt, epruinose, occasionally umbonate. Margin at first distinct, later more or less persistent, black, matt to nitid.

EXCIPULUM: max. 120 - 250 µm, lateral of hymenium 100 - 120 µm thick. Ectal zone black-brown; pigmented zone 10 - 15 µm tall; hyphae 3 - 4.5 µm diam., with lumina of 1 - 1.5 µm. Inner zone pale brown; hyphae 5.5 - 6 µm diam., with lumina of 1 - 3 µm. Medullary zone not obvious.

HYPOTHECIUM: dark brown, 200 - 250 µm thick; hyphae 4 - 4.5 µm diam.; subhymenial layer colourless, 25 - 30 µm thick.

HYMENIUM: 80 - 100 µm tall, colourless, I+ blue, I_{conc.}+ blue. Epihymenium olivaceous, 12 - 16 µm tall. Paraphyses branched and anastomosing, 1.3 - 2 µm, apices 3 - 4 µm thick. Asci c. 70 - 80 x 15 - 19 µm; tholus max. 15 - 19 µm, min. 6 - 9 µm thick; amyloid tube c. 4.5 - 5 µm broad; outer amyloid wall layer 1 µm thick, I+ blue, I_{conc.}+ blue-brown; non-amyloid wall layer 0.5 µm thick. Spores ellipsoid, 12 - 20 x 6 - 9 µm.

Pycnidia: not observed.

CHEMISTRY:

Cortex K-, C-, P-; medulla K-, C- P-; excipulum K-, C-, P-.

One chemotype observed, containing no detectable lichen substance (7 examined specimens).

DISTRIBUTION:

Endemic (?). *P. umbonifera* is restricted to the alpine zone of the south-eastern part of continental Australia (map 60), growing on siliceous rocks in open situations.

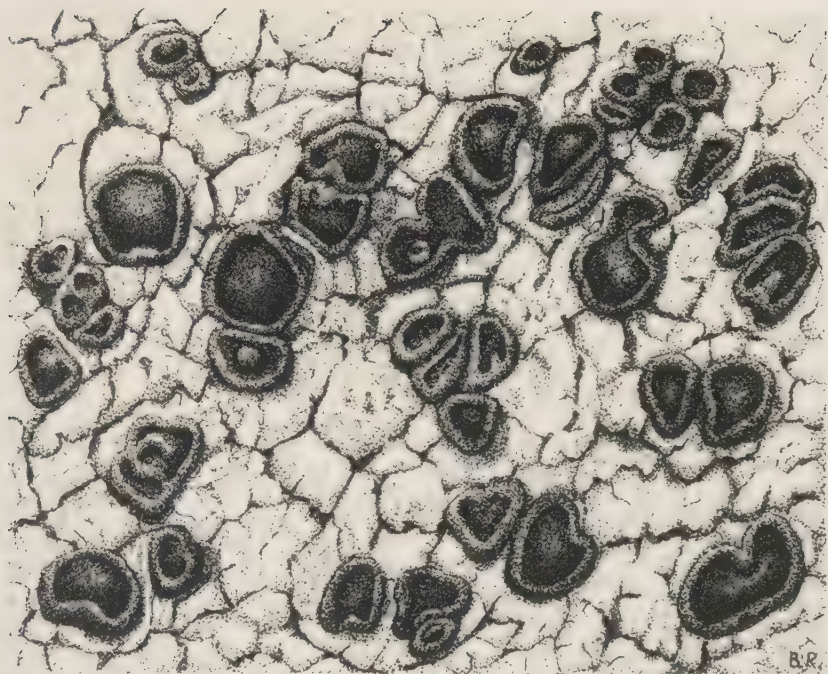


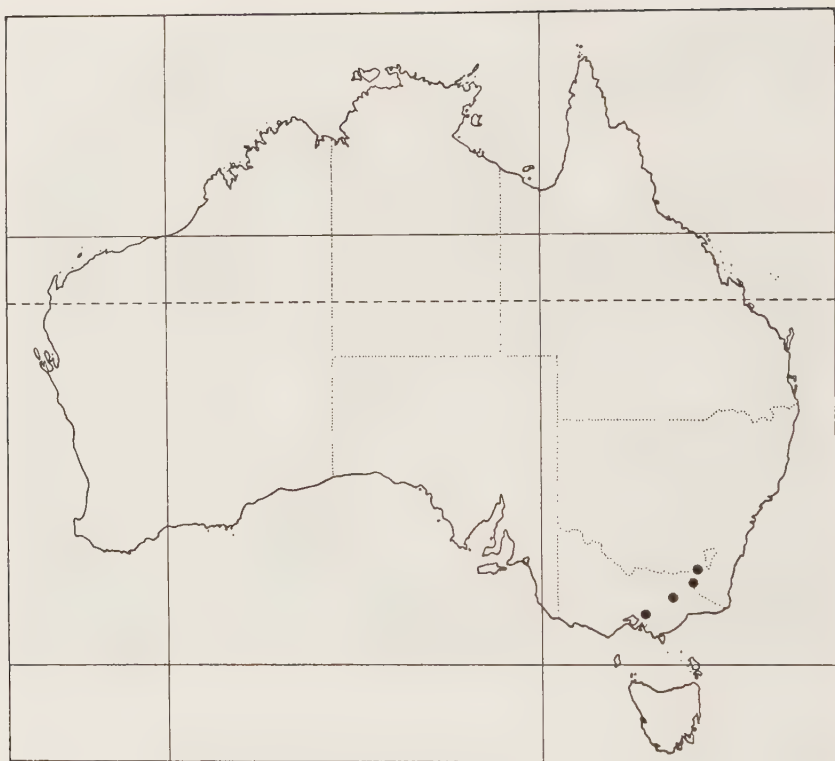
Fig. 29. *Porpidia umbonifera*. (GR 3719, M) Scale = 1 mm.

NOTES:

The species resembles *P. speirea* in that it has an amyloid medulla and similar ecological requirements. The latter differs in having a dark brown pigmentation of the inner zone of the excipulum and by the production of confluent acid as the major substance. The discs of the apothecia occasionally show umbonate structures (fig. 29), but in most of the specimens examined, no umbos were developed. The "isotype" NSW 155895 is not identical with the holotype in G and belongs to *P. speirea*.

SPECIMENS EXAMINED:

New South Wales: Kosciusko National Park, 4 km SW of Kiandra, 35°54'S, 148°27'E, low outcrops beside track between Selwyn Quarry and Mt Selwyn, c. 1600 m, 20.i.1986, leg. G.Rambold 3719 (M); -- Kosciusko National Park, Blue Lake, 36°24'S, 148°19'E, S exposed vertical and overhanging rock walls on north bank of lake, 1900 - 1950 m, 14.i.1986, leg. G.Rambold 3415 (M, NSW); -- Kosciusko National Park, Charlottes Pass Chalet, 36°26'S, 148°20'E, granitic boulders on SE slope SE of Charlottes Pass, 1760 m, 16.i.1986, leg. G.Rambold 3522, 3528 (M).



Map 60. Distribution of *Porpidia umbonifera* in continental Australia

Victoria: Warburton, [37°45'S, 145°42'E], 28.ii.1902, leg. R.A.Bastow (MEL 6976); -- Mt Hotham, [36°59'S, 147°07'E], 5000 ft, 1891, leg. F.R. M.Wilson (G, holotype of *L. contigua* var. *umbonifera* Müll.Arg.).

Rimulariaceae Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 331 - 332 (1984).

Type: *Rimularia* Nyl.

The Rimulariaceae are essentially defined by the characteristic amyloid structures of the tholus (HAFELLNER l.c., fig. 77), non-halonate spores, highly anastomosing paraphyses and a well developed excipulum with a pseudoparenchymatic structure. Hitherto this lichen family included *Rimularia* (incl. *Lambiella* Hertel) as the only genus. A documentation of the genera included in the Rimulariaceae is given in HERTEL & RAMBOLD (in press).

Rimularia Nyl.

NYLANDER, Flora **51**: 346 (1868).

Typus generis: *Rimularia limborina* Nyl. - (holotype).

This genus comprises saxicolous (growing on siliceous rocks), lichenicolous (parasitizing *Lecanora rupicola* agg. and other crustose lichens), corticolous and muscicolous species. Aside from the characters mentioned above, the brown pigmentation of the medulla and of older spores in several species, are specific for this genus.

Table 14. The main diagnostic characters of saxicolous (and lichenicolous) species of *Rimularia* occurring in Australia: ecology, iodine reaction of the medulla, colour of thallus, apothecia gyrodisc, K-reaction of the epihymenium and chemistry
[autotr = autotroph; gyroph = gyrophoric (+ lecanoric acid); norst = norstictic acid; paras = parasitic; viol = violet].

	ecology	medulla	th. colour	ap.gyr.	epihy.	chemistry
<i>R. australis</i>	autotr	I-	grey-brown	±	K-	gyroph
<i>R. exigua</i>	autotr	I-	brownish	-	K-	gyroph
<i>R. insularis</i>	paras	I-	brownish	-	K-	gyroph
<i>R. psephota</i>	autotr	I+ viol	greyish	±	K+ viol	norst

***Rimularia australis* Hertel & Rambold (ined.)**

Type: AUSTRALIA: Queensland: Eungella National Park, NW of Mackay, Mt Dalrymple, 21°02'S, 148°38'E, granite outcrops on summit, 1240 m, 20.ii.1986, leg. G.Rambold 4625 (M, holotype) - [containing gyrophoric acid].

DESCRIPTION:

Thallus: areolate, up to 70 mm diam., c. 0.1 - 0.2 mm thick.

AREOLES: roundish, grey-brown, mostly convex, with more or less smooth surface, c. 0.2 - 0.25 mm, max. 0.3 - 0.5 mm diam. Cortex 5 - 12 µm thick; upper cell layer brown pigmented; hyphae c. 3 - 4 µm diam.; epinecral layer not developed. Algal layer c. 50 - 90 µm thick; algal cells c. 9 - 10 µm, max. 11 µm diam. Medulla I -; hyphae 6 - 7 µm thick, colourless to brown.

HYPOTHALLUS: black, obvious between the areoles.

Apothecia: roundish, mostly dispersed, 8 - 50/cm², sessile and not constricted at the base, rarely subimmersed, c. 0.3 mm, max. 0.4 - 0.5 mm diam. Disc plane, mostly with umbonate structures, brown-black to black, matt, epruinose. Margin at first distinct, later persistent, grey to black, matt.

EXCIPULUM: max. 60 µm, lateral of hymenium 55 - 60 µm thick. Ectal zone dark brown to black-brown; pigmentation 20 - 30 µm tall; hyphae 4 - 5 µm diam., with lumina of 1.5 - 2 µm. Inner zone pale brown to brown; hyphae c. 4 µm diam., with lumina of 2 µm. Medullary zone more or less obvious.

HYPOTHECIUM: dark brown to black-brown, ca. 90 - 100 µm thick; hyphae 4 - 6 µm diam.; subhymenial layer pale brown to colourless, up to more than 20 µm thick.

HYMENIUM: c. 90 µm tall, colourless to pale brownish, I+ red, I_{conc.}+ red. Epihymenium pale brown, c. 15 µm tall. Paraphyses mostly branched, often anastomosing, c. 2 µm, apical 2.5 - 3 µm thick. Asci c. 70 - 90 x 20 - 30 µm; tholus max. c. 20 µm, min. 4 - 7 µm thick; outer amyloid wall layer c. 2 µm thick, I+ red, I_{conc.}+ red; non-amyloid wall layer c. 1 µm thick. Spores ellipsoid, colourless, 15 - 25 x 9 - 15 µm.

Pycnidia: immersed. Conidia cylindrical, c. 3 - 4 x 1 µm.

CHEMISTRY:

Cortex K-, P-, C± rose; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed, containing gyrophoric acid (8 examined specimens).

DISTRIBUTION:

Endemic (?). *R. australis* has been found in W.A., Qld and N.S.W (map 61), growing at lower altitudes on exposed siliceous rocks.



Map 61. Distribution of *Rimularia australis* in continental Australia

NOTES:

R. australis resembles several growthforms of the Northern Hemisphere species *Rimularia badioatra* (Kremp.) Hertel & Rambold, which has a non-isidiate to isidiate, contiguously areolate thallus, containing gyrophoric acid, and mostly umbonate, sessile to subimmersed apothecia. The spores of *R. australis*, however, are much bigger (reaching 25 μm length) and the colour of the areoles is dark brownish-grey instead of brown to pale brown. *Rimularia limborina* which is not known from the Southern Hemisphere, mostly has a less developed thallus, containing no lichen substances, and develops spores which soon become brown. For further discussions to *R. australis* and related species see HERTEL & RAMBOLD (in press).

SPECIMENS EXAMINED:

Western Australia: Armadale Hills, v.1976, leg. J.A.Elix 2690 (ANUC); 40 km SE Armadale, beside Albany Hwy, 32°25'S, 116°16'E, low granite boulders in sclerophyll forest, on horizontal surface, 1.iv.1986, leg. G. Rambold 5270, 5271, 5273, 5285, 5292 (M).

Queensland: Eungella National Park, NW of Mackay, Mt Dalrymple, 21°02'S, 148°38'E, granite outcrops on summit, 1240 m, 20.ii.1986, leg. G.Rambold 4618, 4625, 4631, 4634, 4635, 4637 (M); -- Mt Tinbeerwah, about 5 km W of Tewantin, 26°23'S, 152°58'E, 250 - 260 m, 13.ix.1986, leg. J.Hafellner 15445 (hb. Hafellner); -- Mt Mee State Forest, about 3 km W of the forest station, 27°04'S, 152°44'E, c. 500 m, 13.viii.1986, leg. J.Hafellner 15632, 15635 (hb. Hafellner).

New South Wales: 46 km E of Glen Innes along Hwy 38, [29°37'S, 152°09'E], 1000 m, 18.viii.1976, leg. J.A.Elix 2466 (ANUC).

Rimularia exigua Hertel & Rambold (ined.)

Type: AUSTRALIA: Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3608 (M, holotype; NSW iso-type) - [containing gyrophoric acid].

DESCRIPTION:

Thallus: areolate, up to 35 mm diam., 0.1 - 0.5 mm thick.

AREOLES: irregularly roundish, brown, more or less irregularly convex, with more or less smooth surface, c. 0.1 - 0.3 mm, max. 0.3 (- 0.8) mm diam. Cortex c. 10 µm thick; upper cell layer brown pigmented; hyphae c. 4 - 4.5 µm diam.; epinecral layer up to c. 5 µm, mostly not developed. Algal layer c. 60 - 70 µm thick; algal cells c. 10 µm, max. 11 - 12 µm diam. Medulla I -; hyphae c. 3 - 3.5 µm thick.

HYPOTHALLUS: black, obvious between the areoles, sometimes missing.

Apothecia: roundish, dispersed, 75 - 120/cm², sessile, more or less constricted at the base, c. 0.2 - 0.35 mm, max. 0.2 - 0.6 mm diam. Disc plane, black, matt, epuriose. Margin at first distinct, later persistent, black, mostly nitid.

EXCIPULUM: max. 20 - 50 µm, lateral of hymenium 15 - 50 µm thick. Ectal zone black-brown; pigmentation 25 - 30 µm tall; hyphae 3.5 - 5 µm diam., with lumina of 1.5 - 2 µm. Inner zone dark brown; hyphae 4 - 5 µm diam., with lumina of 1.5 - 2 µm. Medullary zone not obvious.

HYPOTHECIUM: dark brown, 100 - 180 µm thick; hyphae 3 - 5 µm diam.; subhymenial layer colourless to brown, 30 - 40 µm thick.

HYMENIUM: 40 - 70 µm tall, colourless, I+ yellow, Iconc.+ red. Epihymenium olivaceous, 10 - 15 µm tall. Paraphyses often branched and anastomosing, c. 2 µm, apical 2.2 - 3 µm thick. Asci c. 35 - 40 x 15 -

17 μm ; tholus max. 9 - 10 μm , min. 5 μm thick; outer amyloid wall layer c. 1 μm thick, I+ yellow to red, I_{conc.}+ red; non-amyloid wall layer c. 0.3 μm thick. Spores ellipsoid, colourless, (9 -) 10 - 13 x 5 - 8 μm .

Pycnidia: immersed. Conidia cylindrical, c. 4 x 1 μm .

CHEMISTRY:

Cortex K-, P-, C+ rose; medulla K-, P-, C± rose; excipulum K-, P-, C-.

Two chemotypes observed:

- a) containing gyrophoric acid (7 specimens examined);
- b) gyrophoric acid, norstictic acid ($\pm$ traces) (2 specimens examined).

DISTRIBUTION:

Endemic (?). Within continental Australia, the species occurs in S.A. (Flinders Ranges) and in N.S.W. (map 62) at higher altitudes,



Map 62. Distribution of *Rimularia exigua* in continental Australia

growing on various crustose lichens on siliceous rocks in open to sheltered situation.

NOTES:

R. exigua is closely related to the parasitic *R. insularis*, which is distributed in both hemispheres, also produces gyrophoric acid and shows areoles with a smooth, nitid brown surface. The apothecia of both species are sessile and mostly non-umbonate, the spores are $\pm$ colourless. Another rather similar species in the Northern Hemisphere is *R. impavida*, which constantly contains stictic acid as the main substance. However, there are virtually no significant anatomical and morphological differences between these three species. For further discussions see HERTEL & RAMBOLD (in press).

SPECIMENS EXAMINED:

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW exposed sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G.Rambold 5528, 5544 (M).

New South Wales: Tia Falls, c. 30 km SE of Walcha, 31°09'S, 151°51'E, westerly exposed rock beside stream, c. 1000 m, 5.ii.1986, leg. G.Rambold 4271 (M); -- Braidwood Distr., wet sclerophyll forest remnant SE of Rossi, on boulder, 19.xii.1967, leg. W.A.Weber & D.McVean (COLO L-49316); -- Kosciusko National Park, Snowy River Valley near Island Bend, 36°20'S, 148°28'E, 1260 - 1280 m, 3.iii.1985, leg. H.Hertel 31888 (M); -- Kosciusko National Park, "Green Rock", 1 km N of junction of Charlottes Pass - Jindabyne road and road from Island Bend, 36°21'S, 148°29'E, boulders in open *Eucalyptus* forest, 1520 m, 18.i.1986, leg. G.Rambold 3608 (type of *R. exigua* M, NSW), 3610, 3614, 3624, 3627 (M).

A.C.T.: Black Mountain, 5 km NW of Canberra, 35°15'S, 149°06'E, 780 m, dry sclerophyll forest on south-western slopes, 15.vi.1980, leg. H. Streimann 10337 (CBG); -- Booroomba Rocks, 11 km SW of Tharwa [35°33'S, 149°04'E], 1360 m, 11.vii.1979, leg. J.A.Elix 6155 (ANUC).

Rimularia insularis (Nyl.) Rambold & Hertel in Hertel

HERTEL, Lecideac. Exs. fasc. 8: 9, no. 159 (1985); Mitt. Bot. Staatssamml. München 21: 314 - 316 (1985); Mitt. Bot. Staatssamml. München 23: 333 (1987).

= *Lecidea insularis* Nyl., Bot. Not.: 177 (1852); POELT, Planta 51: 305 (1958); ANDERSON, The Genus *Lecidea* Rocky Mtn Nat. Park: 79 - 81 (1964); HERTEL, Herzogia 1: 421 - 423 (1970); Herzogia 2: 487 - 489 (1973); SANTESSON, Lich. Sweden Norway: 167 (1984).

= *Lecidella insularis* (Nyl.) Koerb., Syst. Lich. Germaniae: 239 (1855).

= *Biatora insularis* (Nyl.) Müll.Arg., Mém. Soc. Phys. Genève 16: 393 (1862) [reprints p. 53].

Type: SWEDEN: "ad Holmiam", [near Stockholm], 1852, leg. W.Nylander (H-Nyl. 14.031!, holotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: areolate, parasitizing the thallus of *Lecanora rupicola* agg., up to 15 mm diam., up to c. 0.3 mm thick.

AREOLES: roundish, dark brown, convex, with smooth surface, c. 0.2 - 0.4 mm, max. 0.5 - 0.9 mm diam. Cortex 10 - 30 µm thick; upper cell layer brown pigmented; hyphae c. 4 - 5 µm diam.; epinecral layer 2 - 10 µm thick. Algal layer c. 65 - 100 µm thick; algal cells c. 8 - 11 µm, max. 10 - 15 µm diam. Medulla I -; hyphae 4 - 6 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: irregularly shaped to roundish, crowded, up to 450/cm², mostly not constricted at the base, c. 0.2 - 0.4 mm, max. 0.4 - 0.5 mm diam. Disc plane, black, matt to subnitid, epruinose. Margin at first obvious, later persistent, black, mostly matt.

EXCIPULUM: max. 50 - 70 µm, lateral of hymenium 20 - 40 µm thick. Ectal zone black-brown; pigmented zone 10 - 30 µm tall; hyphae 4.5 - 5 µm diam., with lumina of 1.5 - 2.5 µm. Inner zone brown to colourless; hyphae 4 - 5.5 µm diam., with lumina of c. 2 µm. Medullary zone not obvious.

HYPOTHECIUM: dark to black-brown, 100 - 230 µm thick; hyphae (3 -) 4 - 5 µm diam.; subhymenial layer colourless to brown, 30 - 45 µm thick.

HYMENIUM: 50 - 70 µm tall, colourless, I+ red, Iconc.+ red. Epihymenium olivaceous, 10 - 15 µm tall. Paraphyses branched and often anastomosing, c. 2 µm, apical c. 3.5 µm thick. Asci c. 35 - 55 x 11 - 15 µm; tholus max. 8 - 12 µm, min. 4 - 7 µm thick; outer amyloid wall layer 0.2 - 0.3 µm thick, I+ red, Iconc.+ red; non-amyloid wall layer c. 0.2 µm thick. Spores colourless, rarely tinged brownish, ellipsoid, 8 - 12.5 x 4 - 6 (- 7) µm.

Pycnidia: immersed. Conidia cylindrical, c. 4 x 1 µm.

CHEMISTRY:

Cortex K-, P-, C+ red; medulla K-, P-, C+ red; excipulum K-, P-, C+ red.

One chemotype observed, containing gyrophoric acid (2 specimens examined).

DISTRIBUTION:

Bipolar. New to Australia! According to HERTEL (1985, 1987b) *R. insularis* is widespread in Europe (Spitsbergen, Iceland, Scandinavia, Great Britain, central and eastern Europe, and the Aegean Islands), and occurs in Canada (Alberta, Newfoundland), the western U.S.A., and the Macaronesian Islands (Madeira, Tenerife). In the Southern Hemisphere, the species was previously known from Chile and New Zealand. Within continental Australia, *R. insularis* has been found in S.A., N.S.W., A.C.T., and Vic., parasitizing the thalli of *L. rupicola* (L.) Zahlbr. agg., which grows on exposed non-calcareous rocks in the subalpine to alpine zone (map 63).

NOTES:

This species is well characterized by its nitid brown thallus and its parasitic growth on *L. rupicola* agg. The nonspecificly parasitizing



Map 63. Distribution of *Rimularia insularis* in continental Australia

Northern Hemisphere species *R. furvella* resembles *R. insularis* anatomically and chemically (containing gyrophoric acid), but shows areoles with a rough to granulose surface.

SPECIMENS EXAMINED:

South Australia: Flinders Ranges National Park, St Mary Peak, 31°30'S, 138°33'E, SW sandstone rocks on summit, 1165 m, 8.iv.1986, leg. G. Rambold 5477, 5482, 5522 (M).

New South Wales: Mt Canobolas, 8 km SW of Orange, 33°19'S, 149°00'E, 1390 m, 8.viii.1979, leg. H.Streimann 9190A (CBG); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3739 (M, NSW); -- Kosciusko National Park, Three Mile Creek, 5 km N of Kiandra, 35°50'S, 148°49'E, SE exposed vertical rock face beside Kiandra - Yarrangobilly road, c. 1400 m, 20.i.1986, leg. G.Rambold 3743, 3757, 3764 (M); -- Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E,

2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31667b, 31674 (M).

A.C.T.: Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, [27°26' S, 134°48'E], 1490 m, 19.x.1981, leg. J.A.Elix 9169 (ANUC); -- Brindabella Range, summit of Mt Coree, 31 km W of Canberra, 35°18'S, 148°49'E, rhyolite rocks, 1420 m, 27.i.1986, leg. G.Rambold 4064 (M); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m, 21.i.1984, leg. P.W. James (BM); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4004, 4005, 4058 (M); -- Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°48'E, 1480 - 1490 m, 19.x.1981, leg. V.Wirth 14073 (STU); -- Brindabella Range, summit of Mt Franklin, 45 km WSW of Canberra, [35°29'S, 148°47'E], 1644 m, 29.v.1982, leg. J.A.Elix 10261 (ANUC); -- Bimberi Peak, 35°40'S, 148°48'E, 1800 - 1880 m, 20.x.1981, leg. V.Wirth 10628 (STU).

Victoria: Bogong National Park, Mt Feathertop, beside track on SW slope below summit, 36°54'S, 147°08'E, NE exposed rocks in alpine heath, 1858 m, 4.i.1986, leg. G.Rambold 3147 (M, MEL); -- Bogong High Plains, along the Langford West Aqueduct, Middle Creek, between Scout Hut and Strawberry Saddle, 36°55'S, 147°18'E, 1610 m, 26.ii.1985, leg. H.Hertel 31411 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3052, 3054 (M), 3056 (M, MEL).

Rimularia psephota (Tuck.) Hertel & Rambold in Hertel

HERTEL, Mitt. Bot. Staatssamml. München 23: 334 (1987).

≡ *Lecidea psephota* Tuck., Proc. Amer. Acad. Arts 12: 181 (1877); ZAHLBRÜCKNER, Catal. Lich. Univ. 3: 678 no. 6678 (1925); GALLOWAY, Fl. New Zeal. Lich.: 236 (1985).

≡ *Lambiella psephota* (Tuck.) Hertel, Beih. Nova Hedwigia 79: 460 (1984); HERTEL, Mitt. Bot. Staatssamml. München 21: 317 - 318 (1985).

Type: STRAITS OF MAGELLAN: Nohmck, 14.iii.1872, Hassler Explor.-Exped., leg. T.Hill (FH!, holotype; BM, isotype).

DESCRIPTION:

Thallus: areolate, up to 30 mm diam., c. 0.5 mm thick.

AREOLES: irregularly shaped to angular, grey, more or less convex, with smooth surface, c. 0.4 - 0.5 mm, max. 0.6 - 1.0 mm diam. Cortex c. 10 µm thick; upper cell layer brownish pigmented; hyphae c. 3 - 4.5 µm diam.; epinecral layer c. 5 µm thick. Algal layer c. 60 - 80 µm thick; algal cells c. 9 µm, max. 11 µm diam. Medulla I + violet; hyphae c. 4 µm thick, colourless to brown.

HYPOTHALLUS: black, obvious between the areoles.

Apothecia: irregularly shaped, crowded, c. 60/cm², more or less constricted at the base, c. 0.6 mm, max. 0.9 mm diam. Disc mostly with umbonate structures, black, matt, epruinose. Margin at first distinct, later auriculate, black, subnitid.

EXCIPULUM: max. 40 µm, lateral of hymenium c. 35 - 40 µm thick. Ectal zone black-brown; pigmented zone 25 - 40 µm tall; hyphae c. 4

- 4.5 μm diam., with lumina of 1.5 - 2 μm . Inner zone dark brown; hyphae 3.3 μm diam., with lumina of 1.5 μm . Medullary zone not obvious. HYPOTHECIUM: black-brown, up to c. 250 μm thick; hyphae c. 5 μm diam.; subhymenial layer colourless, c. 50 - 70 μm thick.

HYMENIUM: c. 70 μm tall, colourless, I+ yellowish, Iconc.+ red. Epithymenium brown-green, c. 12 μm tall, K + violet. Paraphyses often branched and anastomosing, c. 2 μm thick, apically 2 - 2.5 μm thick. Asci mostly not well developed; outer amyloid wall layer I+ orange-red, Iconc.+ red. Spores ellipsoid, colourless, later partly brownish, 12.5 - 18 x 8.5 - 10 μm .

Pycnidia: immersed. Conidia cylindrical, c. 5 x 1 μm .

CHEMISTRY:

Cortex K+ red, P+ yellowish, C-; medulla K+ red, P + yellowish, C-; excipulum K-, P-, C-.

One chemotype observed, containing norstictic acid (1 specimen examined).

DISTRIBUTION:

Austral. New to Australia! The Southern Hemisphere species *R. psephota* was previously reported from Chile, Patagonia, Kerguelen Islands, Maquarie Island and New Zealand (North and South Island). Within Australia, it has been found in only one collection from Bimber Peak (map 64), growing on siliceous rock. It seems likely, that the species is more widely distributed in the alpine zone of south-eastern Australia.



Fig. 30. *Rimularia psephota*. (VW 11172, STU) Scale = 1 mm.



Map 64. Distribution of *Rimularia psephota* in continental Australia

NOTES:

Within the Rimulariaceae, *R. psephota* is characterized by an amyloid medulla, the presence of norstictic acid, an epihymenial K-reaction, and more or less gyrodisc apothecia. Gyrodisc apothecia are also observed in *Rimularia australis*.

SPECIMENS EXAMINED:

A.C.T.: Bimberi Peak, 35°40'S, 148°48'E, 1800 - 1880 m, 20.x.1981, leg. V.Wirth 11172 (STU).

Schaereriaceae Choisy ex Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 339 - 400 (1979).

≡ Schaereriaceae Choisy, Bull. Mens. Soc. Lyon **18**: 150 (1949) nom. inval. (ICBN art. 36.1.)

Type: *Schaereria* Th.Fr.

The family Schaereriaceae is characterized by asci with a thin tholus. HAFELLNER (1984 l.c.) considers that this family is related to the Pezizales, by referring to the hymenial structure and the globose spore form. More likely are affinities to the Helotiales s.l. (RAMBOLD & TRIEBEL in press).

Schaereria Th.Fr.

TH.FRIES, Lich. Arctoi: 175 (1860) [nom. cons. prop. - non *Schaereria* Koerb., Syst. Lich. Germaniae: 232 (1855)]; HERTEL, Beih. Nova Hedwigia **79**: 455 (1979).

Typus generis: *Schaereria cinereorufa* (Schaer.) Th.Fr. - (holotype).

Schaereria comprises only saxicolous species. *Sch. cinereorufa*, the type species, is a squamiform representative while the others are crustose. HAFELLNER (1984) considered a generic separation for *Sch. tenebrosa* [= *Schaereria fuscocinerea*] (and related taxa), regarding the a different growth type and alleged differences in the ascocarp anatomy. Such differences, however, could not be observed in the Australian and extra-Australian material analyzed.

Schaereria fuscocinerea (Nyl.) Clauzade & Roux

CLAUZADE & ROUX, Bull. Soc. Centre-Ouest, N.S., Numéro Spécial, **7**: 829 (1985).

≡ *Lecidea fuscocinerea* Nyl., Nya Bot. Notiser: 177 (1852); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 586 - 587 no. 6442 (1925); **8**: 342 (1932); **10**: 308 (1940).

Type: SWEDEN: "Holmiae" (= Stockholm), [no date], leg. W.Nylander (H-Nyl. 15064) - [containing gyrophoric acid, lecanoric acid (traces)].

= *Lecidea tenebrosa* Flot. in Schuchardt **syn. nov.**

SCHUCHARDT, Bot. Zeitung (Berlin) 13: 146 - 147 (1855); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 777 - 778 (1925) - sub *Lecidea gri-seoatra* Flot.

= *Schaereria tenebrosa* (Flot.) Hertel & Poelt in Hawksworth, James & Coppins, Lichenologist 12: 107 (1980); HERTEL, Beih. Nova Hedwigia 79: 456 (1984); SANTESSON, Lich. Sweden Norway: 287 (1984); FILSON, Checklist Austr. Lich. 3. ed.: 20, 172 (1988).

Type: POLAND: Schlesien, Hirschberg, 20.iii.1846, leg. J.v.Floto (O, holotype) - [fide HERTEL 1984].

DESCRIPTION:

Thallus: areolate, up to 30 mm diam., 0.15 - 0.35 mm thick.

AREOLES: angular, dark grey to brown-grey, plane to convex, with rough, rarely smooth surface, c. 0.3 mm, max. 0.4 - 0.7 mm diam. Cortex 10 - 20 µm thick; upper cell layer dark green-grey to brown-green pigmented; hyphae c. 3 - 5 µm diam.; epinecral layer 3 - 7 µm thick. Algal layer c. 70 - 100 µm thick; algal cells c. 10 - 12 µm, max. 14 - 18 µm diam. Medulla I -; hyphae 3 - 5 µm thick.

HYPOTHALLUS: black, obvious at the thallus margin and between the areoles.

Apothecia: round, dispersed, 80 - 120/cm², subimmersed or sessile and not constricted at the base, c. 3 mm, max. 3 - 4 mm diam. Disc plane, black, matt, epruinose. Margin distinct and persistent, black, matt.

EXCIPULUM: max. 35 - 55 µm, lateral of hymenium 35 - 55 µm thick. Ectal zone green-grey; pigmentation 10 - 15 µm tall; hyphae 3.5 - 4.5 µm diam., with lumina of 1.5 - 2 µm. Inner zone colourless; hyphae 4 - 6 µm diam., with lumina of 1.5 - 2 µm. Medullary zone well developed.

HYPOTHECIUM: colourless, brown to dark brown, 60 - 180 µm thick; hyphae 3 - 4 µm diam.; subhymenial layer colourless, 30 - 55 µm thick.

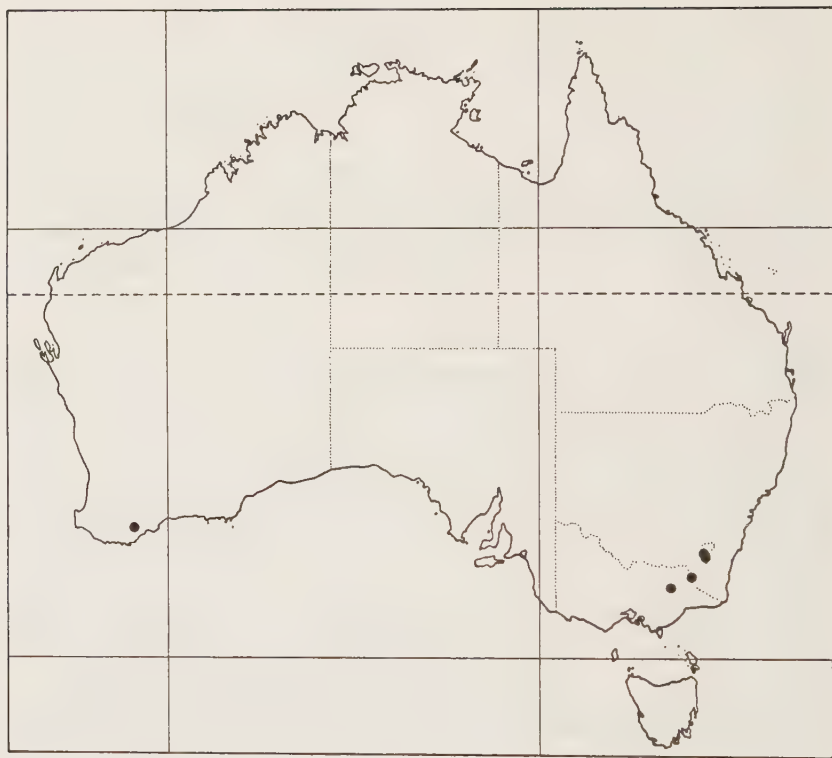
HYMENIUM: 60 - 110 µm tall, colourless, I± blue, I_{conc}-. Epihymenium green, occasionally incrustated with violet granulae, 8 - 12 µm tall. Paraphyses apically branched, not anastomosing, 1.5 - 2 µm, apical 2.5 - 3 (- 4) µm thick. Asci c. 60 - 70 x 10 - 12 µm; tholus max. up to 6 µm, min. 2 - 3 µm thick; outer wall layer not amyloid, not obvious, I-, I_{conc}-. Spores ellipsoid, 11 - 15 x 5 - 6.5 µm.

Pycnidia: immersed. Conidia cylindrical, c. 5.5 - 6.1 - 6.5 x 0.9 - 1.0 µm (according to ZÜRN unpubl.).

CHEMISTRY:

Cortex K-, P-, C+ red; medulla K-, P-, C± red; excipulum K-, P-, C± red.

One chemotype observed, containing gyrophoric acid (major), lecanoric acid (minor) (3 specimens examined).



Map 65. Distribution of *Schaereria fuscocinerea* in continental Australia

DISTRIBUTION:

Bipolar. According to HERTEL (1977: 308 - sub *Lecidea epiiodiza* Nyl., 1981: 183 - sub *Lecidea endocyanea* Stirt.) and ZÜRN (unpubl.), *Sch. fuscocinerea* is distributed in the Arctic region (Greenland, Novaya Zemlya Peninsula), in North America, Iceland, northern and central Europe, and Asia (Nepal). From the Southern Hemisphere, it was reported for South Georgia (HERTEL 1984: 456) and Australia (FILSON 1988a). Within continental Australia the species occurs at higher elevations in W.A., N.S.W., A.C.T. and Vic. (map 65), growing on more or less exposed siliceous rocks.

NOTES:

As with the European representatives of this species, the Australian specimens show significant variability in the adnation (i.e. the degree of immersion of the apothecia) and the deposition of violet granulae in the epihymenium. The latter characteristic has been used as a main

diagnostic feature of *Sch. endocyanea* (Stirt.) Hertel & Schneider, a taxon, which is now regarded as synonymous to *Sch. fuscocinerea* (HERTEL unpubl.). CLAUZADE & ROUX (1985) distinguished *Sch. tenebrosa* from *Sch. fuscocinerea* by a C + red thallus reaction. However the type material of the latter contains gyrophoric acid (together with traces of lecanoric acid) and therefore *Sch. tenebrosa* falls into the synonymy of *Sch. fuscocinerea*.

SPECIMENS EXAMINED:

Western Australia: Stirling Range National Park, Mt Hassell, 34°23'S, 118°04'E, sandstone rocks on summit, c. 848 m, 2.iv.1986, leg. G.Rambold 5378 (M).

New South Wales: Kosciusko National Park, summit of Mt Kosciusko, 36°28'S, 148°18'E, 2140 - 2170 m, 1.iii.1985, leg. H.Hertel 31677 (M).

A.C.T.: Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, schistose rocks, 1480 m, 27.i.1986, leg. G.Rambold 4030, 4039, 4047 (M); -- Booroomba Rocks, 11 km SW of Tharwa, [35°33'S, 149°04'E], 1360 m, 11.vii.1979, leg. J.A.Elix 6155 (ANUC).

Victoria: Bogong National Park, Mt Feathertop, 36°54'S, 147°08'E, 1920 m, 4.i.1986, leg. G.Rambold 3143 (M); -- Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3076 (M).

Schaereria xerophila Rambold & Mayrhofer sp. nov.

DIAGNOSIS:

Similis Schaereriae cinereorufae (Schaer.) Th.Fr., sed epihymenio sub-fusco et thallo ochraceo crustaceoque differt.

Type: AUSTRALIA: Queensland: Nathan Gorge, Cabbagetree crossing, 25°27'S, 150°08'E, 200 m, 27.xi.1985, leg. R.W.Rogers 7848 (BRIU, holotype) - [not analyzed chemically].

DESCRIPTION:

Thallus: areolate, up to 30 mm diam., 0.1 - 0.5 mm thick.

AREOLES: angular, brownish, more or less convex, with smooth surface, c. 0.5 mm, max. 1.0 mm diam. Cortex c. 12 µm thick; upper cell layer brown pigmented; hyphae c. 5 µm diam.; epinecral layer c. 15 µm thick. Algal layer c. 100 - 150 µm thick; algal cells c. 10 - 12 µm, max. 17 µm diam. Medulla I-; hyphae c. 3.5 µm thick.

HYPOTHALLUS: not obvious.

Apothecia: round, dispersed, 80/cm², subimmersed, c. 0.5 mm, max. 0.7 mm diam. Disc plane, black, matt, epruinose. Margin thalline and persistent, brown to black, matt.

EXCIPULUM: max. 55 µm, lateral of hymenium 55 µm thick. Ectal zone brown; pigmentation c. 12 µm tall; hyphae 4 - 5 µm diam., with lumina of 2 µm. Inner zone colourless; hyphae c. 2 µm diam., with lumina of c. 1.3 µm. Medullary zone well developed.

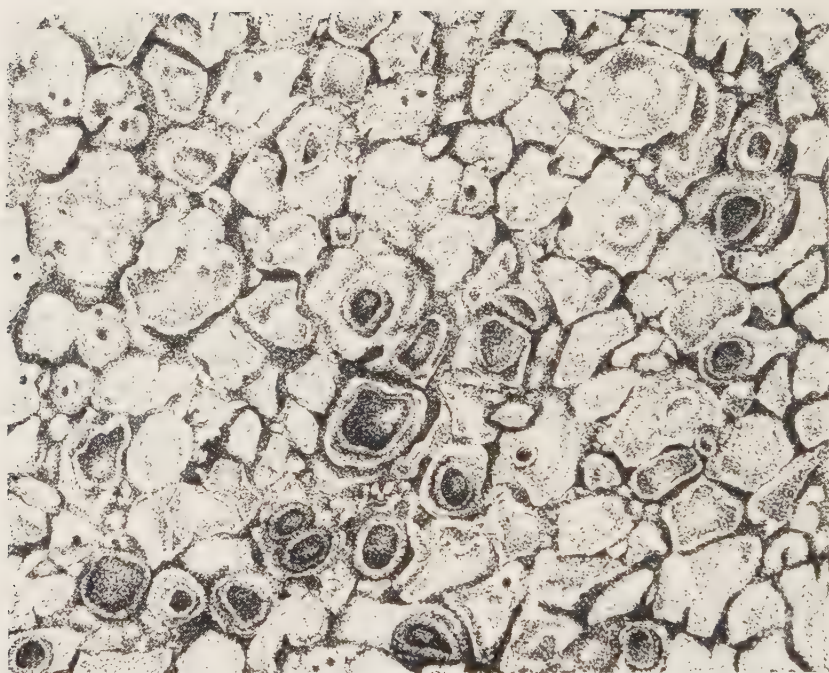


Fig. 31. *Schaereria xerophila*. (RWR 7848, BRIU) Scale = 1 mm.

HYPOTHECIUM: colourless, hyphae c. 4 μm diam.; subhymenial layer colourless.

HYMENIUM: c. 80 μm tall, colourless, I $\pm$ bluish, Iconc.-. Epihymenium brown, 15 - 20 μm tall. Paraphyses sometimes branched, not anastomosing, 1.2 - 2 μm , apical 4 - 5 μm thick. Asci c. 75 - 11 μm ; tholus max. 5 - 8 μm , min. 1.5 - 2 μm thick, not amyloid; outer wall layer I $\pm$ blue, Iconc. + blue. Spores globose, c. 8 - 9 μm diam.

Pycnidia: immersed. Conidia cylindrical, 4.4 - 4.7 - 5.1 x 0.9 - 1.1 μm (according to ZÜRN unpubl.).

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

Not analyzed by TLC (insufficient material). The related *Sch. cinereo-rufa* contains an unknown substance (ELIX in litt.). Fresh thallus sections of this species show (in H_2O) colourless starlike crystals in the medullary zone.

DISTRIBUTION:

Endemic (?). *Sch. xerophila* is only known from the type locality in southern Queensland (map 66), growing on siliceous rock. The related species *Sch. cinereorufa* occurs in the Northern Hemisphere, where it is known from North America and Europe (Island, Scandinavia, Great Britain, the mountainous regions of Central Europe, the Alps and the Carpathian Alps) (POELT & VEZDA 1977: 239, ZÜRN unpubl.).

NOTES:

Sch. xerophila differs from *Sch. cinereorufa* in that it has a less squamulose thallus and a brownish instead of a greenish pigmentation of the epihymenium. Both species have globular spores. The occurrence of *Sch. xerophila* at an altitude of 200 m in south Queensland differs from the ecology exhibited by *Sch. cinereorufa* either, which typically grows at higher elevations (up to the subalpine zone) on more or less vertical, humid surfaces of siliceous rock in sheltered positions (WIRTH 1980, 1987).



Map 66. Distribution of *Schaereria xerophila* in continental Australia

SPECIMEN EXAMINED:

Queensland: Nathan Gorge, Cabbagetree crossing, 25°27'S, 150°08'E, 200 m, 27.xi.1985, leg. R.W.Rogers 7848 (BRIU, holotype of *Sch. xerophila*).

Tremoleciaceae Hafellner

HAFELLNER, Beih. Nova Hedwigia **79**: 347 (1984).

Type: *Tremolecia* Choisy

Tremolecia Choisy

CHOISY, Bull. Mens. Soc. Linn. Lyon **22**: 177 (1953); HERTEL, Khumbu Himal **6** (3): 350 - 351 (1977); Beih. Nova Hedwigia **79**: 457 (1984).

Typus generis: *Tremolecia dicksonii* (J.F.Gmel.) Choisy [= *Tremolecia atrata* (Ach.) Hertel] - (holotype).

Tremolecia atrata (Ach.) Hertel

HERTEL, Mitt. Bot. Staatssamml. München **12**: 501 - 502 (1976); Khumbu Himal **6**(3): 351 - 352 (1977); Herzogia **5**: 462 - 463 (1981); Beih. Nova Hedwigia **79**: 458 (1984); Mitt. Bot. Staatssamml. München **21**: 335 - 336 (1985); GALLOWAY, Fl. New Zeal. Lich.: 585 - 586 (1985); FILSON, Checklist Austr. Lich. 2. ed.: 150 (1986); SCHWAB, Mitt. Bot. Staatssamml. München **22**: 441 - 453 (1986); HERTEL, Mitt. Bot. Staatssamml. München **23**: 337 (1987).

≡ *Gyalecta atrata* Ach., Kongl. Vetensk. Acad. Nya Handl. **29**: 229 (1808).

≡ *Lecidea atrata* (Ach.) Wahlenb., Fl. Lappon.: 475 (1812); HERTEL, Willdenowia **6**: 236 - 238 (1971); Herzogia **2**: 483 (1973).

Type: NORWAY: Finmarken: "In lapidibus siccis ad latus occidentale alpis Rypklubb Qualöae parce", 9.vi.1802, leg. G.Wahlenberg (UPS, lectotype; BM isoelectotype - designated in HERTEL 1977: 351) - [fide HERTEL l.c., SCHWAB (1986)].

DESCRIPTION:

Thallus: rimose-areolate, up to 20 mm diam., 0.1 - 0.2 mm thick.

AREOLES: irregularly shaped, red, rusty coloured, plane, with rough surface, c. 0.3 - 0.4 mm, max. 0.5 - 1.2 mm diam. Cortex 10 - 25 µm thick; upper cell layer incrustated with rusty coloured particles of iron oxides; hyphae c. 3 - 3.5 µm diam.; epinecral layer not developed. Algal layer c. 60 - 70 µm thick; algal cells c. 9 - 11 µm, max. 11 - 13 µm diam. Medulla I -; hyphae c. 3 µm thick.

HYPOTHALLUS: black, obvious at the thallus margin.

Apothecia: round, dispersed to crowded, 80 - 400/cm², subimmersed to immersed, c. 0.3 - 0.4 mm, max. 0.4 - 0.5 (- 0.6) mm diam. Disc plane, black, matt, epruinose. Margin well developed and persistent, black to rusty coloured, matt.

EXCIPULUM: max. 30 - 80 µm, lateral of hymenium 25 - 80 µm thick. Ectal zone black-brown; pigmented zone up to 30 µm tall; hyphae 3 - 4.5 µm diam., with lumina of 1 - 1.5 µm. Inner zone brown; hyphae 3 - 4 µm diam., with lumina of 1 - 3 µm. Medullary zone developed at the basal part.

HYPOTHECIUM: dark brown, 60 - 70 µm thick; hyphae 3 - 4.5 µm diam.; subhymenial layer colourless, 15 - 25 µm thick.

HYMENIUM: 90 - 125 µm tall, colourless, I+ orange, I_{conc.}+ red. Epihymenium colourless to dark grey-green, 10 µm tall. Paraphyses branched and anastomosing, 2 µm, apical 2.5 - 4 µm thick. Asci c. 40 - 65 x 13 - 16 µm; tholus max. c. 10 µm, min. c. 5 µm thick; outer amyloid wall layer 0.2 µm thick, I+ red, I_{conc.}+ red; non-amyloid wall layer not obvious. Spores ellipsoid, 10 - 14 x 6 - 9 µm.

Pycnidia: immersed. Conidia cylindrical, c. 3 - 4 x 1 - 1.2 µm.

CHEMISTRY:

Cortex K-, P-, C-; medulla K-, P-, C-; excipulum K-, P-, C-.

One chemotype observed: containing no detectable lichen substances (3 specimens examined). - According to SCHWAB (1986: 445) this species contains the stictic acid chemosyndrome or lacks lichen substances.

DISTRIBUTION:

Bipolar. New to continental Australia! In the Northern Hemisphere, this worldwide distributed species is known from North America (many localities), South America (Venezuela), Greenland, Iceland, Spitsbergen, Europe, the Canary Islands, the Middle East, and from Asia (U.S.S.R, Nepal, Japan) (HERTEL 1977: 353, fig. 52).

In the Southern Hemisphere, it has been reported from South America (Argentina), Subantarctic Islands (South Georgia, Prince Edward I., Kerguelen I.), Antarctica, East Africa (Tanzania), New Zealand, and Tasmania (HERTEL 1977, 1984, 1985: 336, fig. 10 and 1987b: 337). According to WIRTH (1980: 491) and SCHWAB (1986: 447) *T. atrata* tolerates a very high iron-content in the substrate and grows on magmatic and metamorphic siliceous rock in an open to exposed position. Within continental Australia, it has been collected at two localities in the alpine zone of the Victorian Alps and the Brindabella Range (map 67), growing on basaltic and schistose rock.

NOTES:

This very characteristic species is well defined by its rusty coloured, relatively small thallus, small and concave apothecia, an I + red hymenium, a dark brown hypothecium and a non-amyloid tholus. Anatomically *T. atrata* cannot be confused with any other lecideoid species. A superficial similarity exists with reddish-brown specimens of *Diploschistes bisporus* (Bagl.) Steiner.



Map 67. Distribution of *Tremolecia atrata* in continental Australia

SPECIMENS EXAMINED:

A.C.T. West face of Mt Aggie, just below summit, Brindabella Range, [27°26'S, 134°48'E], 1480 m, 28.iii.1979, leg. J.A.Elix 5863 (ANUC); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1490 m, 21.i.1984, leg. P.W.James (BM); -- Brindabella Range, summit of Mt Aggie, 43 km WSW of Canberra, 35°28'S, 148°46'E, 1480 m, 27.i.1986, leg. G.Rambold 4015, 4038 (M).

Victoria: Bogong National Park, Mt Loch, 36°57'S, 147°09'E, 1885 m, 3.i.1986, leg. G.Rambold 3079 (M).

4. EXCLUDED GENERA AND SPECIES

In this study the lecideoid genera *Fuscidea* V. Wirth & Vězda (INOUE 1981a, b, OBERHOLLENZER & WIRTH 1984), *Protoblastenia* (Zahlbr.) Steiner, and *Trapelia* Choisy, which all include saxicolous species, have been excluded, because the knowledge of the Extra-Australian taxa still is too poor. Data on Australian representatives of *Orphniospora* Koerb. have been published recently by HERTEL & RAMBOLD (1988b). Other lecideoid genera occurring in Australia and comprising only corticolous or muscicolous species, or showing psoroid growth form are: *Eremastrella* S.Vogel (SCHNEIDER 1980, ALMBORN 1987), *Hypocenomyce* Choisy (SCHNEIDER l.c., TIMDAL 1984a), *Miltidea* Stirt. (GALLOWAY 1985, LUMBSCH 1988), and *Psora* Hoffm (SCHNEIDER l.c., TIMDAL 1984b, 1987a).

The following taxa were excluded from this revision:

Lecanora subcoarctata (Knight) Hertel

HERTEL, Beih. Nova Hedwigia **79**: 448 (1984); Mitt. Bot. Staatssamml. München **21**: 319 - 321 (1985).

= *Lecidea subcoarctata* Knight, Trans. & Proc. New Zealand Inst. **8**: 316 - 317 (1876); GALLOWAY, Fl. New Zeal. Lich.: 238 (1985).

= *Biatora subcoarctata* (Knight) Hellb., Bih. Kongl. Svenska Vetensk.-Akad. Handl. **21** afd.III no. 13: 106 (1896).

Type: NEW ZEALAND: Wellington, [no date], leg. Ch. Knight (BM, lectotype; M!, isoelectotype - designated in Hertel 1984) - [containing atranorin, arthothelin, thiophanic acid].

= *Lecidea insulana* Müll.Arg. **syn. nov.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier **3** (12): 640 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. **3**: 785 no. 7081 (1925); WEBER & WETMORE, Beih. Nova Hedwigia **41**: 52 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 47 (1983); Checklist Austr. Lich. 2. ed.: 60 (1986); Austr. Fl. Fauna Ser. **4**: 120 (1986); Checklist Austr. Lich. 3. ed.: 19, 104 (1988).

Type: AUSTRALIA: Queensland: "Thursday Island", 1887, leg. Ch. Knight 284 (G!, lectotype, designated here!).

L. subcoarctata has been reported from continental Australia in one collection, the type of *Lecidea insulana* Müll.Arg. According to the label and the original description, this type specimen has been collected in Thursday Island (north Queensland). Anatomically and chemically identical specimens of *L. subcoarctata* were hitherto known from the subtropical to temperate areas of New Zealand, growing on

rock at low altitudes. It seems probable, that the type of *L. insulana* was not collected in north Queensland, nor in continental Australia, and for this reason the taxon has been excluded from this study.

***Lecidea aspidula* var. *dispersa* Müll.Arg.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 3: 640 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 735 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 51 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 45 (1983); Checklist Austr. Lich. 2. ed.: 57 (1986); Austr. Fl. Fauna Ser. 4: 112 (1986); Checklist Austr. Lich. 3. ed.: 18, 101 (1988).

Type: AUSTRALIA: Queensland: "Thursday Island", 1887, leg. Ch. Knight 283 (G!, holotype).

According to the label on the specimen and the original description, *L. aspidula* var. *dispersa* was collected on Thursday Island (north Queensland) by Ch. Knight. Like *Lecidea insulana* and *Lecidea nesophila* [= *Lecidella sublapicida*], which were described from the same locality, the species probably derives from another, perhaps extra-Australian, locality. As no other specimens of *L. aspidula* var. *dispersa* (a species of *Biatora*), has been found in Australia thus far, this taxon has been excluded from this study.

***Lecidea selenospora* Müll.Arg.**

MÜLLER ARGOVIENSIS, Bull. Herb. Boissier 3: 640 - 641 (1895); ZAHLBRUCKNER, Catal. Lich. Univ. 3: 830 no. 7258 (1925); WEBER & WETMORE, Beih. Nova Hedwigia 41: 54 (1972); FILSON, Checklist Austr. Lich. 1. ed.: 50 (1983); Checklist Austr. Lich. 2. ed.: 63 (1986); Austr. Fl. Fauna Ser. 4: 129 (1986); Checklist Austr. Lich. 3. ed.: 20, 106 (1988).

Type: AUSTRALIA: New South Wales, 1887, leg. Ch. Knight 39 (G!, holotype) - [sterile, no lichen substances found by TLC].

The type specimen of *Lecidea selenospora* Müll.Arg. shows only a sterile, dirty coloured thallus without characteristic morphological features, which lacks lichen substances. An identification of this taxon with the present methodology was not possible.

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